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Gas Journal

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Vol. 245. 97th Year. LONDON, JANUARY 31, 1945. No. 4263
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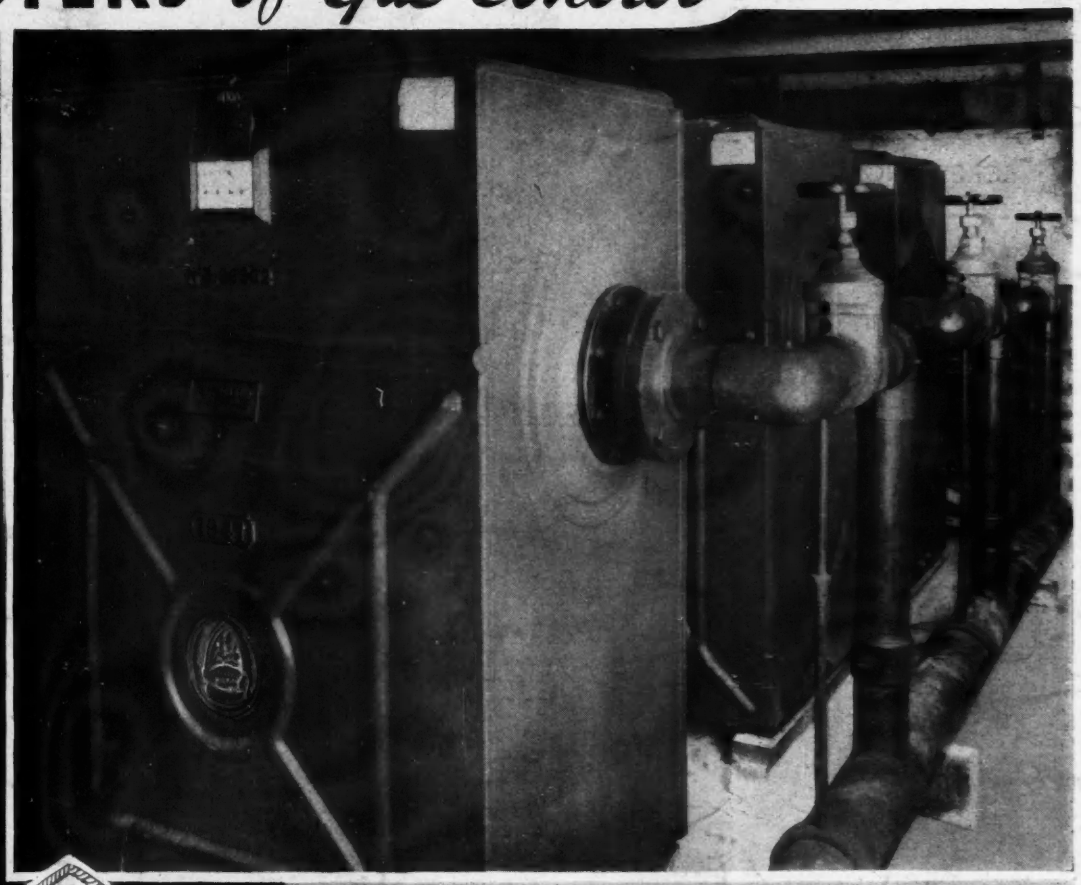

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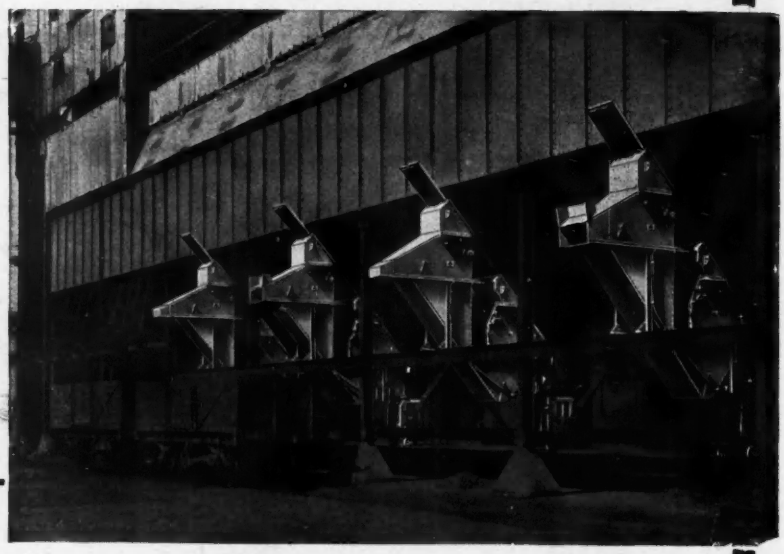

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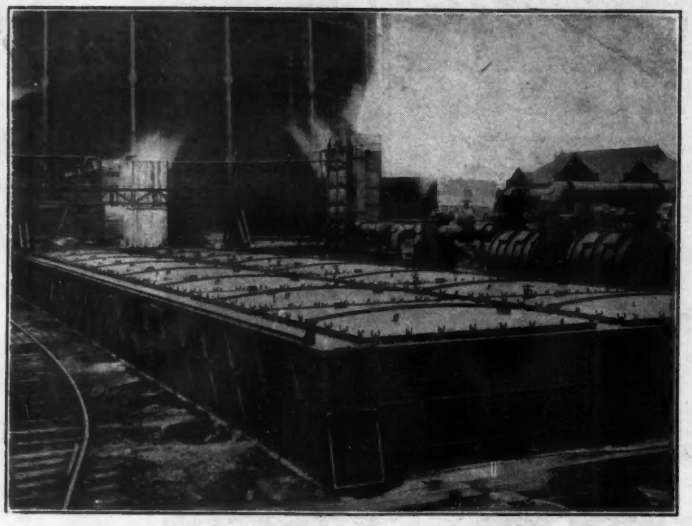

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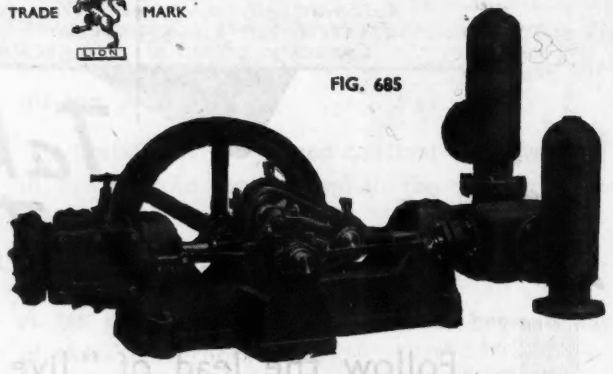
FIG. 685



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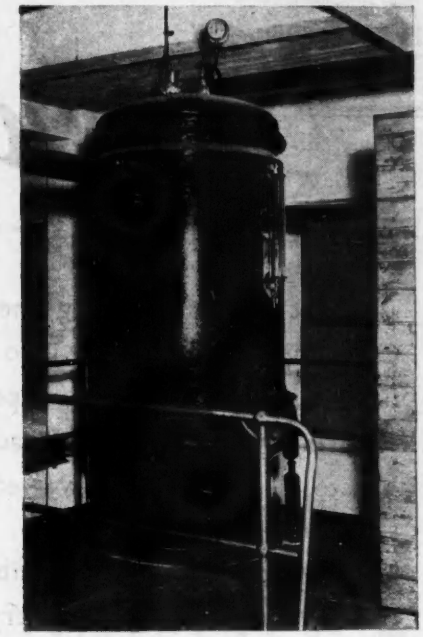
CONTINUOUS BLOWDOWN



By courtesy of the Middlesex County Council and Messrs. Davey, Paxman & Co. Ltd.

The illustration shows the Continuous Blowdown and Heat Recovery installation for four Davey, Paxman boilers at the Central Middlesex County Hospital. This equipment follows a similar installation at the same Authority's Chase Farm Hospital, where, also, Filtrol water-softening plant is in operation.

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NOTABLE DEVELOPMENTS IN ENGINEERING HISTORY, 1

Old SOUTHWARK

The illustration shows the galleries of the famous "George Inn," Borough High Street. This hostelry was in existence in the time of Stow, but in 1676 was totally destroyed in the fire that raged over the greater part of the Borough. The present building, therefore, dates from the 17th century and now belongs to the National Trust. Annually, on Shakespeare's Birthday, scenes from his plays are performed in the inn-yard.

CALLED "Suthgeweorke" in A.D. 1023 and nowadays "The Borough" Southwark is one of the oldest parts of London and derives its name from being originally the fortified bridge-head of the City.

The Romans had a settlement here and what is now the Dover Road from London Bridge *via* Great Dover Street to the Country beyond aligns with the old Watling Street. This artery made Southwark a hub of traffic and travel.

From here Chaucer's Pilgrims set out from the old Tabard Inn, and by the 18th Century from the Borough alone 143 Stage Coaches started and returned each week. The locality became famous for its trade and enterprise; its Inns; its Theatres, of which the "Globe" is the best remembered; its Priory—St. Mary Overies, now Southwark Cathedral; its Palaces—that of the Bishop of Winchester; its Prisons—the Marshalsea and the Kings Bench; its Hospitals —Guy's being the most notable; and its Literary associations, among which are the names of Shakespeare, Goldsmith, Johnson, Keats, and Dickens. By the end of the 18th Century, the industrial growth of Southwark was rapid and in 1844 this development was augmented by the founding of an engineering undertaking, the name of which was to become widely known in its own particular field of industry. The Founder of this concern was John Dewrance, the erector of George Stephenson's Locomotive "The Rocket," and was at one time a locomotive superintendent of he old Liverpool and Manchester Railway.

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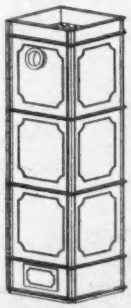

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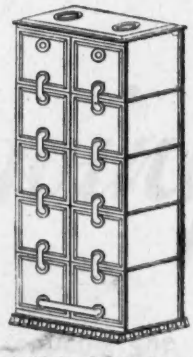

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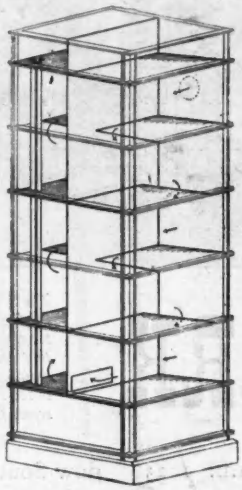

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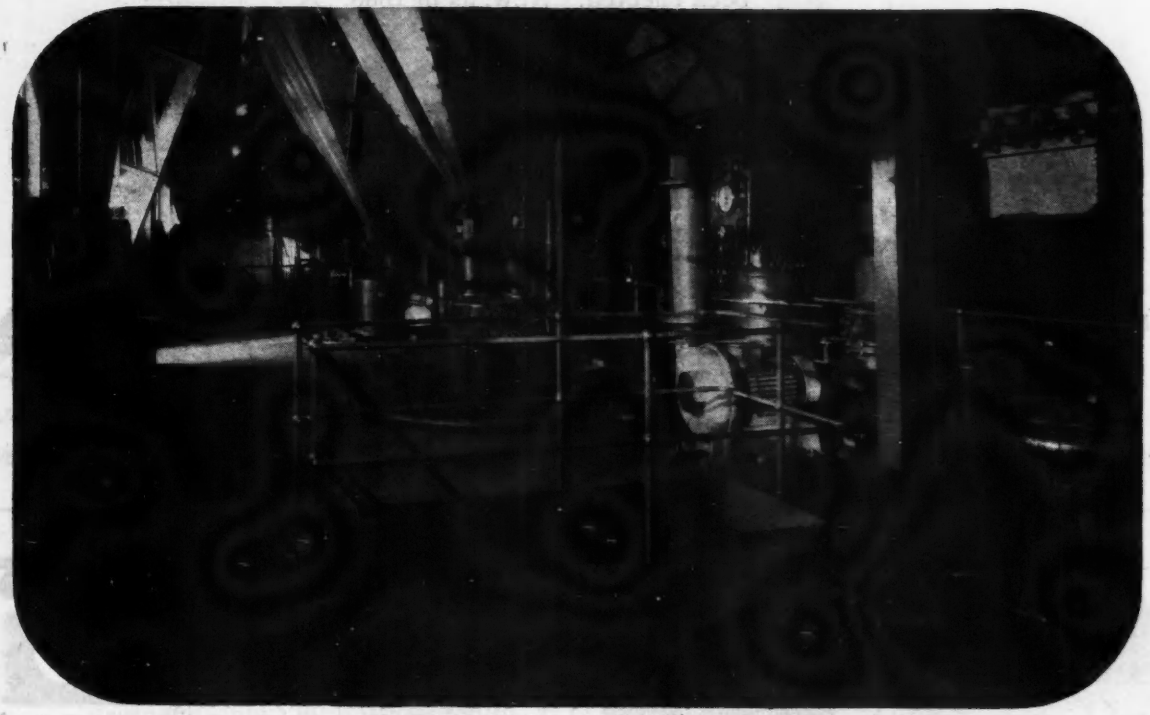

General view of operating platform of Producer plant.

Installation of five mechanical self-vapourising Gas Producers each gasifying half a ton of Coke and manufacturing 75,000 cub. ft. of 130 B.T.U. Gas per hr. We design, manufacture and erect Gas Producer Plant to individual requirements.

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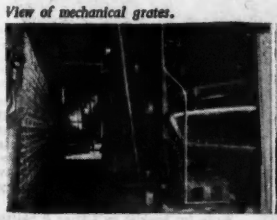
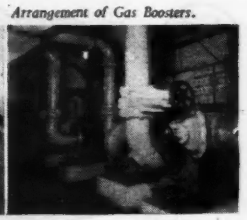
View of mechanical grates.



Outside view of building.

Fuel Handling Plant.

Arrangement of Gas Boosters.



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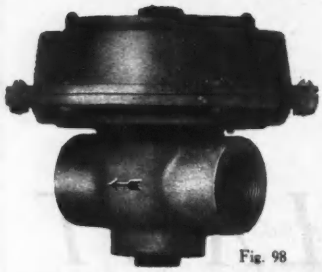

Fig. 98

DIAPHRAGM GOVERNOR

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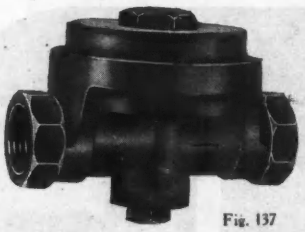

Fig. 137

GAS APPLIANCE GOVERNOR

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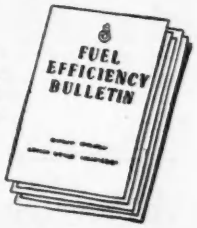

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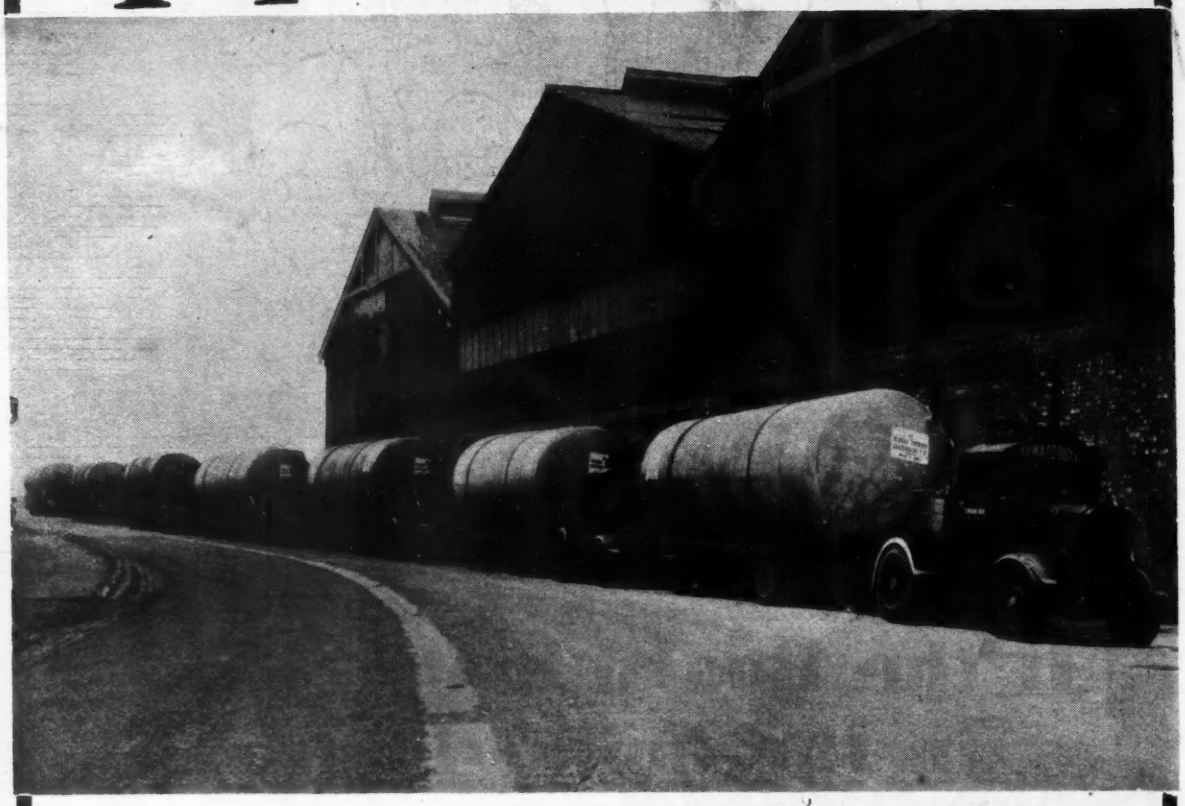

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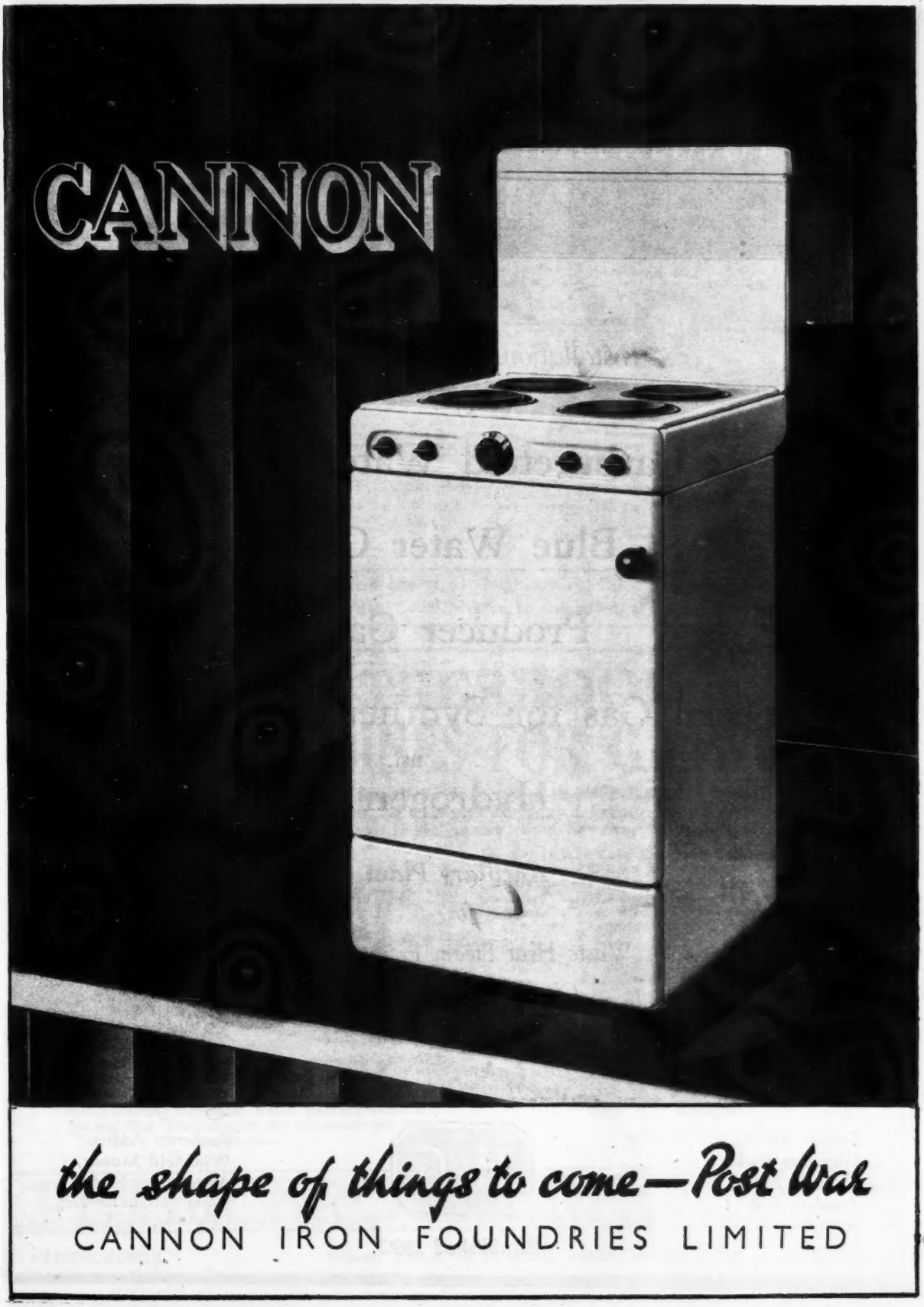

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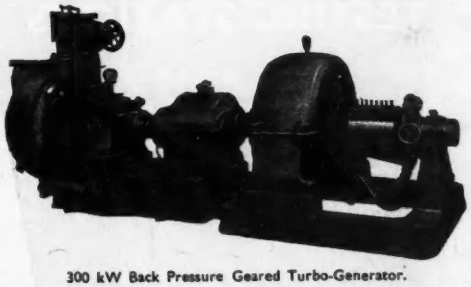

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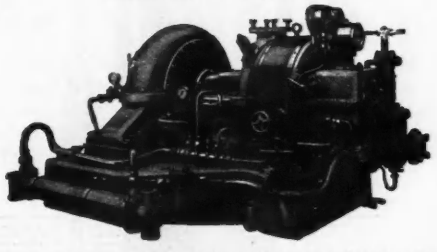

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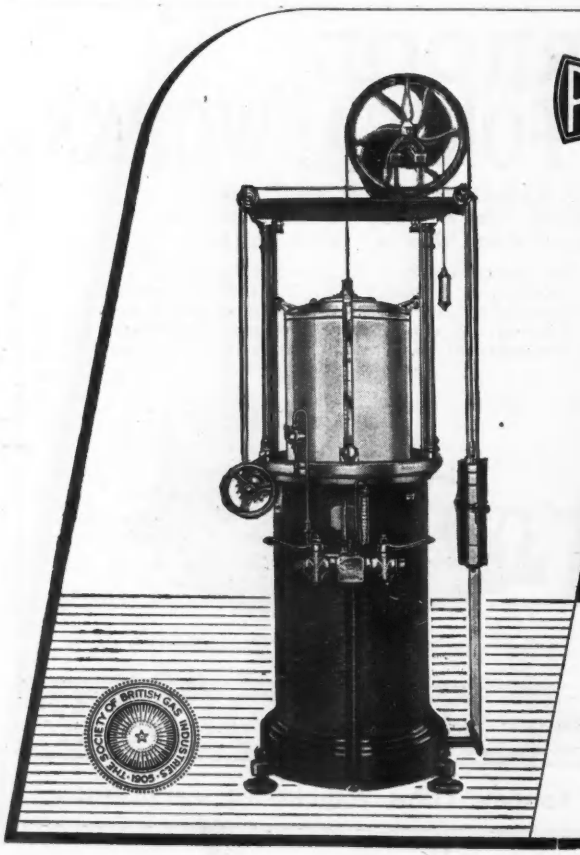

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GAS JOURNAL, JAN. 31, 1945

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EDITORIAL NOTES

IS THERE A SOLUTION?

DURING the past twenty years there have been many noteworthy and noble aspirations concerning co-operation in the fuel field. Particularly since the start of the present war there has been a veritable spate of fine words urging that the production, distribution, and utilization of all fuels should be regarded as a single problem—that each fuel should be used in the sphere best fitted for it, with the interests of the nation—the wisest use of our coal resources—as the basic consideration. To what extent have we advanced towards the goal? Whence and when shall come the guidance? Are recommendations regarding wasteful competition between the fuel industries to be implemented? Only last week we commented on what would appear to be a prelude to a renewed and more vicious dog-fight between gas and electricity for the post-war domestic load—*i.e.*, cooking, water heating, laundry, and refrigeration—the prelude to a possible 1945–? fuel war being the present out-and-out competition for the servicing of temporary dwellings. Is this uncontrolled activity a preliminary to wholesale hostility?

The whole problem, of course, calls for flexibility; whatever the contents of the consumer's pocket, he should be allowed, as far as possible, freedom of choice of the fuel he shall use to provide comfort. It is not a question of an all-coal policy, an all-electricity policy, or an all-gas policy; but there does seem room for a much more rational fuel plan in the national interest, for a more balanced view of the purposes to which the products of coal treatment—gas, electricity, and solid smokeless fuel—are best suited economically, nationally, and individually. Are the various interests to regard themselves as warring sections seeking to secure existence at the expense of each other, or as complementary parts of a composite fuel industry? As we have said, the importance of an answer to the question has not been overlooked during the past twenty years; but an answer is yet awaited. Time passes. In the not so recent Planning Report of the B.G.F., duly forwarded to the Ministry of Fuel and Power, it was set out that the Gas Industry neither possesses nor seeks any monopoly either under the State or under its present structure. It merely asked that it should have equality of opportunity among its competitors, and that consumers should have reasonable freedom of choice among the fuels available to them; and it urged the establishment of a National Fuel Advisory Council.

A year ago the Minister of Fuel and Power decided to set up such a body to deal in an advisory capacity, on the broadest lines and without bias, with the general fuel problem. The Council's constitution and terms of reference, announced in November last, made the intention clear. There is also the Committee of Enquiry into the Gas Industry, appointed by the Minister of Fuel last June. In view of what is actually happening in seemingly haphazard and strictly parochial ways in regard to the heat service equipment of temporary dwellings, is it out of place and time to reiterate a hope previously expressed in these columns that the Advisory Council will give its guidance and recommendation on some all-embracing fuel plan maintaining a balance between conservation of resources and the comfort and freedom of the people?

GAS-MAKING ECONOMY

OF late the idea, which has much to recommend it, has been put into practice at meetings of Gas Industry technical bodies, both Senior and Junior Associations, of an Author giving the same Address or presenting a single Paper to more than one audience. From the proceedings of the various Associations during the past year we could pick on several examples. Dr. Dent topped the bill with his contribution on the production of gaseous hydrocarbons by the hydrogenation of coal, which he introduced for discussion before four Associations—two in the Midlands, the Southern, and the Eastern Counties—giving ample scope for the expression of viewpoint on a subject of outstanding importance. For some time the practice has been adopted to good effect by kindred professional bodies.

Another example—more modest in range, nevertheless having much practical virtue and giving rise to useful discussion—was the recent Paper by Mr. C. A. Deas on day-to-day operation and control of the retort house, our report of which we concluded in the "JOURNAL" last week. The Paper should have particular appeal and be specially helpful to the young gas engineer, the man on the job. The Author laid great but not undue emphasis on the need for and benefits from maintaining good general working conditions—cleanliness, adequate ventilation and lighting (both natural and artificial, regarding which much could be said), and so on; and some of the points he made regarding gas-making economy and efficiency certainly call for thought. Primarily concerned with the horizontal retort house, Mr. Deas was emphatic that, for the best all-round results, the charge of coal should completely fill the retort—a practice, he maintained, giving maximum coal throughput, which in turn gives minimum fuel consumption in producers, reduces pipe troubles, eliminates naphthalene trouble, minimizes scurf formation, and requires the least expenditure of labour for a given coal throughput. Again, "pull" in the retorts is to be avoided like the plague; level gauge to a very slight pressure in each retort should be the aim. Incidentally he urged scurfing of the retorts at intervals far shorter than commonly obtain in practice. Highest coal throughput, he argued, will give the highest calorific value gas in addition to the most reactive coke, accompanied by the largest total yield of gaseous therms from a given size of carbonizing unit. There is much to be said for Mr. Deas' argument, but it implies more attention to the coke market than has commonly been given to this aspect of the carbonizing process in the past.

This matter of high throughput as the guiding criterion not unnaturally led the Author to discuss steaming; and here again Mr. Deas was emphatic in saying that a horizontal retort is an inefficient water gas generator; attempt to use it as such results in a drop in coal throughput and thermal output and an increase in producer fuel consumption. We think it is generally agreed that steaming in horizontal retorts is not an economic practice, but the Author went on to apply his remarks on steaming in horizontals to steaming in vertical retort installations, particularly of the intermittent type, suggesting that it is better, from the dual point of view of fuel economy and sound finance, to produce water gas, if it is required as a diluent, under con-

trolled conditions in a plant designed expressly for the purpose. In this regard we would call attention to the extremely useful figures of coke consumption for the production of water gas in both continuous and intermittent verticals given by Dr. Pexton in the course of the discussion on the Paper ("JOURNAL," Jan. 17, p. 83). For continuous verticals the figures showed a yield of blue water gas by steaming equivalent to 240 therms per ton of dry coke consumed—a result appreciably better than that obtained from a separate water gas plant; and, said Dr. Pexton, the higher capital and labour costs of making water gas in continuous vertical retorts were thereby justified. With intermittent verticals, the figures showed that with greater degrees of steaming than about 8% a greater coke consumption per therm of water gas is involved than with a separate water gas generator.

We would refer to just one other item of great general interest concerning horizontal retort practice mentioned in the Paper, and that is recirculation of the waste gases in the setting. This matter was discussed at length in a Paper by Mr. Muir Wilson published in the "JOURNAL" early last year (issue of Jan. 19, p. 89), when it was stated that by such recirculation a gain in throughput of coal of at least 10% could be obtained without increase of combustion chamber temperature; alternatively, the same throughput could be obtained with lower combustion chamber temperatures. A good deal of experience has now been gained or is being gained working on this principle, for the full benefits of which adequate producer capacity is needed. In the discussion on Mr. Deas' Paper Mr. Wilson was able to amplify his previous statements, saying that after a year of experience and careful investigation by the South Metropolitan Gas Company the advantages mentioned accrued, though on the grounds of fuel economy there would appear to be nothing to choose between recirculation settings and settings of standard design.

"A Plan for Coal"

"A Plan for Coal," being a report to the colliery owners by Mr. Robert Foot, Chairman of the Mining Association of Great Britain, was published by the Association last week. It is the outcome of a task on which Mr. Foot has been engaged ever since his appointment as Chief Officer of the Association last May, and his conclusions, placed primarily before the Mining Association, are also before the miners and the public for discussion. As was to be expected, the report has met with widespread publicity in the Press, and the document is available for all closely concerned with the subject to study. It is written with a clarity of style wholly admirable, and has been generally welcomed as a carefully studied, sincere, and lucid statement. Obviously of importance to the Gas Industry, one of the largest single consumers of coal, on which raw material its very existence depends, the document also holds for the Industry a particular and personal interest in that its author was for several years within the Industry as General Manager of the Gas Light and Coke Company. General criticism of the document appears to be that Mr. Foot has not gone far enough in terms of execution of his proposals, and, of course, it will not satisfy the many who are dead set on nationalization at all costs. The underlying principle which Mr. Foot lays down is the organization of the coal industry for national service. His main proposal is a system of central and district control to be established by the colliery owners to ensure the observance of 20 governing principles making for efficiency of production, the well-being of the workers, with wage stability, a reasonable return for capital, and the assurance of the continuing development of the industry under the direction of a central board and district boards. Regarding amalgamations Mr. Foot says: "Amalgamations should and, I am satisfied, will come; but I am convinced that, with the following exceptions, they ought to be allowed to follow naturally and by agreement. The two exceptions, in each of which I feel that it would be right for the pace to be forced, and if necessary compulsion to be applied, are: (*a*) If an undertaking, be it big or small, fails to accept or to operate in an efficient manner the decisions of the central board; (*b*) if an undertaking, because of its size or other particular circumstances, though willing, is, in the opinion of the board, not in a position to conduct its operations in accordance with the standard of efficiency laid down." Later in this issue of the "JOURNAL" we give from the report the 20 principles for the conduct of the industry which Mr. Foot lays down.

Personal

Major DARRELL W. REES, M.B.E., Engineer and Manager of the Pembroke District Gas Company, has been elected a member of the Pembroke Town Council.

* * *

Mr. GEORGE SHUKER, Storekeeper at the Gas-Works, Albion, of the West Bromwich Gas Department, has received the B.E.M. for meritorious service in the Home Guard.

Letters to the Editor

Retort House Operation and Control

DEAR SIR,—In regard to Mr. Deas' reply to my comments on his recent Paper, which was published in the "JOURNAL" of Jan. 10, I should like to say that on the question of "completely filled" retorts, conditions in the other types of plant mentioned by the Author, particularly the continuous system, are by no means analogous to those in horizontals; but even if higher pressures are inevitable in the former there are good reasons for avoiding them when possible.

During experiments with which I have been concerned on horizontal retorts there has been proof of pressure amounting to several inches water gauge due to blocked or uneven charges (we are all familiar, for instance, with the obvious excessive pressure in single pipe retorts when over-filled); and since segmental silica retorts in good condition will leak about ¾ therm per ton of coal carbonized for every 1/10 of an inch differential pressure across the retort walls, the advantage of avoiding such loss is evident. There was also ample evidence that the growth of scurf is considerably accelerated where conditions of pressure are allowed to exist. In addition the best all-round results were obtained only with a slight gasway over the coal as charged; this of course would be less important with a non-swelling coal.

As regards the possibility of leaving a layer of scurf on retorts, this will be more even in the case of oval than in the ⌂ shaped; nevertheless I assure Mr. Deas that it is quite possible to leave a reasonably thin and even layer, though not perhaps over the complete surface, on the retort.

I am reported as saying "on the economics of steaming in intermittent verticals, the two main considerations were the comparative costs, therm for therm, of water gas in a separate plant." This should be completed as follows: "or without cost except for the loss of throughput in the carbonizing plant; and the varying cost of the latter method depending on the proportion of steaming up to the economic limit." By this I intended to imply that in the case of the carbonizing plant the capital and labour costs remain the same whether steaming is practised or not, and that the cost of steaming should be that proportion of the total retort house charges represented by the percentage of water gas therms made in relationship to the coal gas therms made.

Gas-Works,
Southend-on-Sea.
Jan. 22, 1945.

Yours faithfully,
G. L. BRAIDWOOD.

"Electricity and New Homes"

DEAR SIR,—In your Editorial under the heading "Electricity and New Homes," published in the "JOURNAL" of Jan. 24, you pointed out what must to all of us engaged within the Gas Industry be a matter for serious concern—namely, "certain of the reports which reach us of the meetings of housing committees and the like from various parts of the country are not to us a source of wild optimism."

The reason for the current "wave of enthusiasm for electricity" can scarcely be attributed to any shortcomings of the Gas Industry's straightforward advertising, which no one will deny has always been of a very high standard, but is it not rather the failure of the Industry as a whole to live up to the claims of its advertising? At the same time it is to be deplored how we fail to fire the public imagination by the story of gas. "Shareholder," in his letter to you published on Jan. 24, cites, for example, the recent story of the Balloon Barrage, and there are many more both in war and peace that never get beyond the Technical Press. If the same effort were expended in informing the general public of our activities as is expended in our telling each other of our perfections, the service we provide might enjoy a much more prominent place in the public mind.

In the British Gas Federation's Report on the Planning of the Gas Industry it is stated that 357 undertakings supplied in seven industrial areas 72% of the gas sold in the country. It also states that 647 undertakings supplied in country areas 7.5% of the total gas sold. Assuming the gas service supplied by the 357 larger undertakings approaches that standard claimed by our advertising, it may safely be assumed that the service supplied by the 647 smaller undertakings falls far short of that standard, and as housing authorities naturally form their opinions on gas or any service by conditions experienced around them, it follows that 647 smaller gas undertakings influence a very large number of these authorities.

Evidence of the poor service provided by the smaller undertakings appears only too frequently in the Provincial Press, where one reads case after case of the local authority complaining to the local gas undertaking of "bad gas," but one does not see anywhere local

authorities complaining of "bad electricity." Admittedly it has recently become necessary for electricity supplies to be cut on a national basis—the publicity value of which is not overlooked by the electrical industry!—but is not this much better than supplying gas irregular in quality and pressure? Pleading wartime difficulties is not sufficient excuse to the lay mind for the steady decline in gas service, from a none too good starting-point at the outbreak of war. After all, wartime difficulties have not produced "bad electricity."

Who would blame a local authority who desire to fit temporary or permanent dwellings with all-electric equipment? At least they do know then that they will be providing the occupant with a fuel service which remains constant, for the same housing authority have probably had bitter experience of a gas service which is far from satisfactory; and while there remain so many hundreds of small undertakings with antiquated equipment and antiquated ideas of operation, it is not surprising that many housing authorities take a "poor view" of gas as a modern domestic fuel.

Westfield House,
Dursley, Glos.
Jan. 27, 1945.

Yours faithfully.
T. L. TALLENTIRE.

Ministry of Fuel and Power

Major Gwilym Lloyd George, Minister of Fuel and Power, has appointed Professor J. M. Mackintosh, M.D., F.R.C.P., D.P.H., as a member of the Fuel and Power Advisory Council. Professor Mackintosh is Professor of Public Health at the University of London, and Dean of the London School of Hygiene and Tropical Medicine; formerly he was Chief Medical Officer of the Department of Health for Scotland and Professor of Public Health at the University of Glasgow.

Diary

Feb. 3.—Scottish Junior Gas Association: Joint Meeting of Eastern and Western Districts, Heriot-Watt College, Edinburgh. Address by Arthur Forshaw.

Feb. 5.—Gas Industry Kitchen Planning Exhibition, Dorland Hall, Lower Regent Street, London. Opening and Private View.

Feb. 6–March 3.—Gas Industry Kitchen Planning Exhibition, Dorland Hall, Lower Regent Street, London. 10 a.m. to 5 p.m. (Thursdays, 10 a.m. to 6 p.m.)

Feb. 7.—Southern Association of Gas Engineers and Managers (Eastern District): Gas Industry House, 2.30 p.m. Paper by T. Brown (General Manager, South Suburban Gas Company), "Housing Developments and the Gas Industry."

Feb. 13.—National Federation of Gas Coke Associations, General Committee: Gas Industry House, 10 a.m.

Feb. 14.—Institute of Fuel (North-Western Section): Grosvenor Museum, Chester. Paper by A. L. Longworth on "Thermostatic Control."

Feb. 19.—London and Counties Coke Association: Finance Committee, 11 a.m.; Executive Committee, 11.30 a.m.; Central Committee, 1.30 p.m., Gas Industry House.

Feb. 23.—Institute of Fuel: Joint Conference with National Smoke Abatement Society.

Feb. 24.—Manchester and District Junior Gas Association: Address by Dr. J. G. King, Director of the Gas Research Board.

Feb. 24.—Yorkshire Junior Gas Association: Meeting at Bradford. Paper by A. Cole.

Feb. 28.—Institute of Fuel (North-West Section): Conference on Preparation of Coal. Engineers' Club, Manchester, 10.30 a.m.

Mar. 21.—Southern Association of Gas Engineers and Managers (Eastern District): Gas Industry House, 2.30 p.m. Paper by J. E. Davis (South Metropolitan).

Mar. 22.—Midland Counties Coke Association: Annual Meeting, King Edward House, Birmingham, 2.30 p.m.

Scottish Juniors

A Meeting of the Scottish Junior Gas Association (Eastern District) was held in the Heriot-Watt College, Edinburgh, on Jan. 13. Mr. W. Masterton presided and introduced Dr. K. E. Grew, a Lecturer in Physics at the College, who delivered an Address on "Thermal Diffusion and its Application to the Separation of Gases," during the course of which he gave two practical demonstrations: (1) The thermal diffusion effect; (2) a separating column using convective circulation to increase the separation due to thermal diffusion. A short discussion followed, and Dr. Grew replied to the points raised.

Mr. Masterton thanked the Lecturer for his Address and for the practical demonstrations given.

At a meeting of the Western District, held on Jan. 13 in the Royal Technical College, Glasgow, Mr. A. MacFadyen, Dumbarton, presiding, Mr. W. B. Wright, of Colville's, Ltd., read a Paper on the "Practical Application of Industrial Instruments to the Gas Industry."

The speaker suggested that better use might be made of such instruments, and that there might be greater co-ordination between the designers and manufacturers, on the one hand, and users on the other.

Fuel Equipment of Temporary Houses

The question whether Accrington's temporary houses should be equipped with electricity or gas, or both, led to a discussion at a recent meeting of the Town Council, when the Housing Committee put forward a recommendation that electricity only should be provided, the Chairman of the Committee, Councillor Bell, maintaining that electricity was cleaner and more efficient than gas.

Moving back the recommendation Councillor Constantine said that both gas and electricity had their place and there should be no antagonism between the two. The two services should be complementary. The Ministry had decided the services must be all electric or all gas. He thought housewives preferred gas cookers and gas wash-boilers, and in Accrington there were nine gas cookers to one electric cooker. After the war, when there would be new electrical appliances, housewives would still prefer gas cookers and wash-boilers. He suggested that one estate should be on gas and the other on electricity.

Sir Thomas Higham, Chairman of the Electricity Committee, said if they had to choose between the two he would say "electricity" for many reasons, health particularly. Councillor Ledwick suggested that the modern generation favoured electricity. To this Councillor Constantine replied that he had an all-electric house, and because of his experience he did not want others to repeat the mistake. Councillor Bell said electricity was the better service. The Ministry would supply electrical equipment, and electrical fittings were much handier than gas. There was no need for tapers or matches. It was cleaner, and there were no dirty walls, &c. On relative merits his Committee favoured electricity.

An amendment referring the Housing Committee's minute back was carried by 15 votes to 13.

Edinburgh Corporation Housing Committee at a recent meeting decided to adhere unanimously to its previous decision to service the temporary houses erected at Muirhouse and Sighthill with electricity to the exclusion of gas. The decision was reached following consultation with a deputation from the Gas Sub-Committee of the Public Utilities Committee.

The 140 temporary houses which are to be erected at Hawick, Roxburghshire, will have gas cookers, gas-heated wash-boilers, and gas-operated refrigerators. This follows on the discussion which arose at a previous meeting of the Town Council as to the relative merits of gas or electricity for this purpose. The Town Clerk stated that a questionnaire was sent to 70 married couples in the town, all belonging to the category likely to be given one of the houses; 54 replies were received out of the 70, the voting being 40–14 in favour of electricity. This was queried by a Council member who had asked 25 women, all of whom had favoured electricity for lighting, but not for cooking. When it was attempted to compare costs this was found to be difficult, since it could not be decided whether 10 electrical units equalled a therm, or whether the figure should be 20 units.

After a great deal of discussion a vote gave gas the decision by 8 votes to 4, but a further meeting was arranged, in spite of this vote, and further discussion went on. The final full dress debate, during which it was stated that schemes in various parts of Scotland had reverted from electricity to gas, resulted in a 7–5 vote in favour of gas, following which the Town Clerk asked for an assurance that no effort would be made to revive the controversy.

The Estates Committee of the Southport Town Council have resolved to inform the Ministry of Works that the Council desired gas cookers, gas boilers, and gas refrigerators to be provided for the temporary bungalows allocated to Southport.

Councillor H. W. Barber moved an amendment in favour of the all-electric house, and on a vote this amendment was rejected by one vote (21 to 20). Councillor Barber did not see why electricity should not be used. The inclusive charge of electricity for a family of three, as offered by the Electrical Engineer, was only 3s. 8d. per week on the two-part tariff. Councillor J. J. Irvin, Vice-Chairman of the Estates Committee, supported. "The rooms of prefabricated houses are so small," he said, "that vitiation of the atmosphere would reach serious proportions if gas were used." Councillor Wilkinson said he found housewives were all in favour of gas for the purposes mentioned. Councillor Mrs. Haigh favoured gas in large rooms, "but in these tiny little houses, where there is not much air and accommodation is limited, I think a trial of the all-electric service would be a good thing, but only if the housewives who are to occupy these houses are trained in the use of electricity." Councillor Mrs. Smith said: "Unless housewives learn how to use the conserved heat of the electric cooker I think there is going to be a good deal of waste. I may be old-fashioned but I prefer gas for cooking." Councillor Drewitt, Chairman of the Estates Committee, said the Gas Engineer had quoted a weekly cost for gas of 2s. 3d. for three persons.

As stated, the amendment was defeated by one vote—21 to 20.

The fact that goods made of raw materials in short supply owing to war conditions are advertised in the "Journal" should not be taken as an indication that they are necessarily available for export.

A Plan for Coal

We give the 20 principles for the conduct of the mining industry which Mr. Robert Foot, Chairman of the Mining Association, lays down in a report, "A Plan for Coal," to the colliery owners. The report was published by the Mining Association last week, and is the outcome of a task on which Mr. Foot has been engaged since his appointment to the Association in May of last year. The chief proposal is a system of central and district control to be established to ensure the observance of the principles set out.

The central board would consist, according to Mr. Foot's plan, of 15 members and a full-time chairman. The members would be men of high standing and good reputation, actively engaged in the industry, who could be relied upon to approach their responsibilities in a statesmanlike way and to think nationally and not sectionally. Each district board (or the board of a group of small districts) would also have a full-time chairman and a technical committee (on a voluntary basis), which would carry out the preliminary surveys and the subsequent inspections. The permanent district chairmen would be the two-way channel for contact between the district and each undertaking in it and the chairman of the central board. The central board would have a constitution and powers to enable it to apply the 20 governing principles (and any others that may be added from time to time).

The 20 principles are as follows:

1. The industry should take a national conception of its responsibilities to the country, and should look upon the industry broadly as one family with branches in every coal-producing area, each undertaking being independent and self-supporting under all normal conditions, but all mutually interested in the prosperity of the whole and organized to solve all its problems, financial, technical, or commercial, within its own four walls.

2. Mining should be in accordance with the best mining principles and practice, with due regard to adequate supplies, at a proper price and of the proper quality, to the present generation, to the importance of the conservation of coal resources for future generations, and to the safety of mining operations.

3. The industry to be organized to make available at any time to all undertakings the best professional advice, technical, industrial, commercial. District arrangements should permit of the provision of power, the pumping of water, the purchase and stocking of stores and materials and engineering workshops with the greatest measure of economy and efficiency.

4. The industry to be brought as quickly as practicable to, and progressively maintained in, the highest state of efficiency that modern knowledge and the geological and other conditions will allow. This will include the mining operations themselves, the sinking of new pits where necessary, the handling and transport of the coal below and above ground, and its preparation for the market.

5. The industry, acting through the Central Board and the district boards, to give every support and encouragement to the closer integration of the industry into a smaller number of units by voluntary agreements and to compulsory amalgamations or absorptions in special circumstances.

6. In the interests of the workers, no existing pit to be closed or new pit opened unless the central board, on the advice of the district board, is satisfied in the first case that all practicable arrangements have been made for the absorption and accommodation of the men elsewhere, and in the second case that due consideration has been given to the housing, transport, and general welfare of the men to be employed.

7. The commercial arrangements for the disposal and sale of coal and its distribution at home and abroad should ensure (*a*) positive and progressive selling into every market with a view to its expansion, full development of the present selling arrangements, together with the elimination of inter-colliery and inter-district competition and power to enable the selling organizations to give financial support to business when necessary in the interest of the industry as a whole; (*b*) fullest possible employment of each producing unit throughout the year; (*c*) elimination of unnecessary distribution charges; (*d*) technical advice to consumers on the purchase and use of the coal most suitable to their requirements; (*e*) close contact with consumers and information to enable the consumer to judge of the fairness of the price.

8. Workers to be ensured a wage and stability of employment and general conditions that will give them a good standard of living throughout their working life, the earnings of underground workers to be maintained at a level giving them pride of place among industrial workers.

9. A reasonable return on the capital employed in the industry after allowing for proper appropriation for amortization, depreciation of plant, and development.

10. Workers to be fully informed of the progress and circumstances of the industry; the joint national committee to be maintained along with a suitable joint committee in each district and pit production committees; the constitution of pit committees to be enlarged and no matter established as one of national principle to be excluded from the discussions of the district or pit committees.

11. The comprehensive district and national conciliation machinery to remain, along with ultimate recourse to a national tribunal independent of the industry for final and binding decisions.

12. The best modern principles of labour administration and management to be applied throughout the industry. Under this heading are the general health and morale of the workers; discipline, labour management, and leadership; proper and impartial handling of all cases of suspension or dismissal; prompt discussion and settlement of all grievances and local wages questions appropriate for individual settlement; training and education; impartial handling of opportunities for upgrading and promotion; general welfare.

13. The best safety practice to be applied by every colliery undertaking; the joint national and district safety boards to have every support.

14. Support and financial backing for research.

15. Proper arrangements for recruitment and for the education and training of new entrants; further training and education for those already employed.

16. The workers to have the right to call these principles to their aid in any matter in which the principles designed for their protection are not kept fully in operation.

17. Close contacts and consultation on all matters involving national policy with the Minister of Fuel and Power.

18. Close contact with the Coal Commission nationally and in the districts.

19. The central board to have legal powers to provide at its sole discretion any moneys necessary to finance any colliery undertaking either for capital or revenue purposes, and for this purpose either to raise loans itself or guarantee loans raised by other means. If any security other than that which can be provided by the assets of the particular undertaking is necessary the central board should be at liberty to give such security. The central board should be authorized to make levies.

20. Subject to faithful adherence to these principles, and to the proper carrying out of any decisions of the central board, it shall be a principle also that there shall be no interference—financial or otherwise—with the autonomy, independence, and power of decision of any colliery undertaking in its own individual management and enterprise, or with the normal activities of the district organizations.

Gasworkers' Strike at Manchester

Another strike of shift workers at the Bradford Road Works of the Manchester Gas Department—the third strike at the works in the past nine months—broke out on Monday afternoon of last week, and troops were called in to man the gas-making plant. The trouble occurred after the Manchester Stipendiary Magistrate had issued committal orders against 34 shift workers at the Bradford Road Works who had failed to pay fines of £10 imposed on Nov. 10 for refusing to obey a direction of the Ministry of Labour to return to work after striking a few days earlier. Only two men paid the fine. The men had ceased work because their demand for payment at the rate of time and a third for night shift workers had been refused. Police officers on the day of the strike visited the homes of the men who had refused to pay the fines, and 30 were arrested and taken to prison. When news of the arrests reached the gas-works, men due to start on their shift refused to work, and by 10 o'clock the strike had spread to 140 men. Gas pressure to 220,000 users was reduced to half.

The release of the men from prison took place the next day, their fines being paid for them by the Manager, but the workers defeated a proposal to resume work on the Tuesday, by which time only 86 of the 450 employees were on duty. There were fears that the trouble would spread to the key workers. The difficulties were, of course, accentuated by the extremely cold weather, with a demand for gas 10% greater than in the corresponding period of last year, coupled with coal transport difficulties and lack of man-power owing to increased sickness. The position was, in fact, becoming more serious, and it was found necessary to cut down the pressure to industrial users. Salford's gas supplies were affected and pressure was reduced to the Manchester level.

Gas pressure had to be further reduced on the following day—to a third of normal—and stocks at the works amounted to only 3,000,000 cu.ft. Nineteen of the men on strike returned to work, but after a meeting the remainder decided to remain on strike until a meeting could be arranged with the Gas Committee. In refusing this request, Mr. J. H. Cadman, Commercial Manager to the Gas Department, pointed out that the men's claims should be dealt with through their trade union and the normal industrial machinery.

The strike came to an end on the Thursday, when all the men resumed work on the night shift and the troops were withdrawn.

University of Leeds

The following degrees were among those conferred at the University of Leeds on Jan. 23:

B.Sc. (*Honours*) *Gas Engineering, First Class:* G. Cleaver, N. L. Franklin, D. B. Leason, J. C. C. Ransom, A. B. Whitehead.

B.Sc. Metallurgy, First Class: G. Fenton, K. J. Irvine, J. Nutting. *Second Class:* G. Clough, D. Shaw. *Aegrotat:* Jean R. Bayly.

B.Sc. (*Ordinary*) *Gas Engineering:* K. H. Brown.

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Town Gas in the Processing of Glass Tableware*

By J. A. TOMES, Deputy Engineer, Stourbridge Gas Department

(*Concluded from p. 125*)

The furnace has now been at work without major repairs for nine years, and the Department is at present designing a similar furnace for the School having an extra pot.

(B) Furnace Pots

Good pot life is as important to the glass manufacturer as retort life is to us, and to ensure this, since the pot is in fact an enormous piece of pottery or clay-ware, accurate temperature control is essential throughout the whole of its life. This is borne out by the fact that one of our principal glass manufacturers now employs a maker to mould the pots on his works instead of purchasing them from the firebrick manufacturers.

Making of the Pots

The pots are made from a mixture of best quality raw fireclay and grog from which as much of the iron impurity has been removed as possible, the proportion and type of each varying with the type of glass to be melted, furnace conditions, and working properties of the clay-grog mixture.

From the time making is commenced until the pot is sufficiently matured to leave the pot room for the glass works approximately six months must elapse. During this time the pot is made by hand and matured in two rooms maintained at certain humidities (between 65 and 80%) and controlled temperatures (between 55° and 65°F.) in order to sweat the moisture out of the pot. The method adopted for this purpose consists of a hot water system employing an "Ideal" gas-fired boiler supplying two rooms at present, but with an allowance for extension in post-war years. A pot-maker with 25 years' experience states that he has never witnessed better drying conditions.

The pots are made in the larger room, and are partly dried and then transferred to the small room for maturing. Each room has its own circuit, consisting of 4 in. W.I. pipes fixed overhead and in ducts below the ground, each circuit being separately controlled by a magnetic valve operated by a room thermostat. Each loop in the circuit is provided with a valve for hand control, and these controlled loops give the pot-maker command over air circulation. The pots are made on a stand about 6 in. from the ground to enable him to take full advantage of this.

The maker also requires humidity control. This is accomplished by sealing the rooms and providing each with its own separate overhead air duct, the admission of air being controlled by a butterfly valve, so allowing the right atmosphere to be maintained without fear of draughts. Provision is made by the firm for the absorption of the excess moisture from the atmosphere in the drying-rooms.

The pipes are lagged wherever they may give any localized heat to the pot, however slight, and the provision of wide pipe ducts enables a large volume of warm air to circulate, whereas the use of smaller ducts as is the practice in standard central heating jobs would mean air being circulated at a higher velocity, and tending to dry too rapidly the section of the pot over which it passed.

The period spent by the pot in each room is decided by the maker, but a total of six months is usually the minimum, with about three months in the moulding room. The pots are then sold or used in rotation as made, so that each is ensured of the maximum maturing time.

Pot-Arching

Even at this stage, if delivered to the purchasers, it must be stored till needed in a dry atmosphere free from chills, at a controlled temperature, and must then be heated slowly to about 1,150°C. (the actual temperature varies with different works between 1,100 and 1,200°C.), when it can be "set" in the furnace. This is carried out in a subsidiary furnace known as a pot-arch, and this period is a critical time in the life of the pot, as the temperature must be raised slowly over a period of approximately 6 to 7 days, avoiding at all times uneven heating or flame contact. Pyrometer control is essential.

In typical 2-pot pot-arches built by the Department recuperation is effected by passing the air for combustion through refractory tubes above the heating chamber, or alternatively the secondary air is preheated by its travel through ducts situated below the furnace floor. The burners for the furnace, of which there are three either side, consist of a short length (6 in.) of ¼ in. dia. heat-resisting steel tube firing upwards through a burner block. The supply pipe for these passes along the secondary air duct. The travel of the heating gases and the fact that the pot stands on bricks, so that it is higher than the flue outlet, ensure that it is of even temperature throughout. The small amount of gas required in the early stages means that the burners are at this time merely luminous candle flames, but the subsequent addition of gas and air to suit the heat requirements causes it to burn correctly at the burner nostril. Before commencing to fire, the front of the furnace is usually sealed with a 3 in. insulating wall, the purpose of this being to act as a barrier for cold air, which may be indrawn should the clay seal on the furnace doors fail.

When up to temperature the front of the pot furnace is torn down, and the old pot removed, while an iron carriage is pushed under the new pot in the pot-arch, which is quickly transferred to the pot furnace, lowered into position, and the front bricked up again, the whole job occupying some 20–30 minutes.

The pot is usually considered safe so long as its temperature is kept above approximately 700°C. (with a critical temperature of 575°C.), so that by heating the pot to, say, 1,150°C. a safety margin of 450°C. is provided to allow for the drop in temperature in transferring the pot from the pot-arch to the furnace.

The results obtained are as follows:

	Consumption.				
	Daily (cu.ft.).		Daily (therms).	Av. hourly (cu.ft.).	Pot-arch temperature.
Gas on 4 p.m. Fri.					70° 4 p.m.
4 p.m. Fri.–9 a.m. Sat.	3,300	(17 hrs.)	14.85	194	195° 9 a.m.
9 a.m. Sat.–9 a.m. Sun.	5,000	(24 hrs.)	22.50	208	315° 9 a.m.
9 a.m. Sun.–9 a.m. Mon.	6,200	,,	27.90	258	480° 9 a.m.
9 a.m. Mon.–9 a.m. Tues.	11,600	,,	52.20	483	645° 9 a.m.
9 a.m. Tues.–9 a.m. Wed.	14,400	,,	64.80	600	790° 9 a.m.
9 a.m. Wed.–9 a.m. Thurs.	15,500	,,	69.75	646	935° 9 a.m.
9 a.m. Thurs.–9 a.m. Fri.	18,700	,,	84.15	779	1,060° 9 a.m.
9 a.m. Fri.–4 p.m. Fri.	5,600	(7 hrs.)	25.20	800	1,100° 4 p.m.
Gas off 4 p.m. Fri. ...	80,300	Total	361.35		

Town gas has displaced solid fuel on at least 90% of pot-arches in the district, and by more even heating has improved the life of the pots. For example, figures given by one firm indicate that in over 10 years since gas firing of pot-arches was introduced not one pot has been lost due to faulty arching, whereas previously, using solid fuel, quite a number failed owing to uneven temperature conditions before they even entered the pot furnace.

Films Resulting from Use of Town Gas with Open-firing

One of the principal causes of complaint from the glass works in all processes in which the ware comes into direct contact with open flame, or the products of combustion (as may happen in any of the remaining processes except decorating), is that in certain circumstances films may be found on the articles. This is particularly the case with lead crystal ware, and before proceeding further it may be best to discuss the question of these chemical effects, their cause and prevention.

When glass is heated in an open flame there are two main chemical effects which occur by inter-action between the flame or the products of combustion and the glass itself. These are:

(*a*) The formation of a chemical reduction film, which occurs when lead ware is heated in a reducing atmosphere and is characterized by the article being stained black by a film of metallic lead. Lead oxide is speedily robbed of its oxygen and reduced to the metal, and with a reducing flame the hydrogen or hydrocarbons in town gas can do this, giving the resulting black film, which is only removable by washing the article in a warm mixture of hydrofluoric and sulphuric acid (known as acid washing). The remedy is to heat the article in that portion of the flame where oxidizing conditions obtain or to adjust the air gas ratio to give these conditions, when the trouble entirely vanishes.

(*b*) The chemical reaction film which takes the form of a white mist and is commonly known as "bloom." This is caused as a result of sulphurizing due to the sulphur compounds other than H_2S in the gas. Although this occurs with both soda lime and lead crystal glass, it is a particular source of trouble with the latter. The sulphur forms sulphur dioxide, which with oxygen from the air can react, particularly with sodium oxide and lead oxide, to produce sulphate. Sodium sulphate film is capable of being washed off with water, but that of lead sulphate may only be removed by acid washing, which dissolves a thin film of glass from the surface of the article. Although the glass industry realizes that bloom imparts mechanical strength to the glass, it has caused them and the Department endless trouble in the past, as besides necessitating acid washing, it prevents handles of jugs, feet of bowls, &c., from sticking to the body of the article. In the past these have left the article without leaving a mark, either immediately after annealing or some days after, or even after selling to the purchaser. It will be appreciated that without bloom there exists no reason for acid washing plain ware, so that before the war, when much of the ware was cut, and consequently acid washed, bloom, although a nuisance with plain ware, was not such a big problem as it is to-day, due to the restriction on the sale of cut glass and the granting of large contracts for plain ware. These factors have forced the glass works to seek the only apparent remedy—that is, the installation of de-sulphurizing plants.

* From a Paper to the Midland Junior Gas Association.

(C) Reheating of the Ware for Shaping

Three men and two boys work at each pot, being known respectively as the "foot-blower," "servitor," and "maker," and the two boys as the "gatherer" and "taker-in." The duties of the men in, for example, the making of a jug would be as follows: The metal being plain and ready for working, a fireclay ring made in sections is inserted through the pot mouth, its purpose being to allow the "gatherer" to "gather" the metal from inside it, and so give freedom from impurities lying on the surface. The "foot-blower" then collects a "gathering" by rotating a steel tube with a heat-resisting nozzle, (about 4 ft. 6 in. long and ¾ in. diameter, with a centre hole) on the surface of the metal, and proceeds primarily to "marver" the solid mass by rolling to and fro along a C.I. plate with a plained and polished surface and then to blow the article. The "servitor" prepares the primary shape and casts on the foot, which has been gathered and prepared for him by the "gatherer." The article is then transferred to the "maker," who shears off the unwanted glass and reheats the article before forming spout and casting on the handle (also prepared by the gatherer). Upon completion the article is transferred on the end of a wooden rod to lehr for annealing by the "taker-in." Originally the "maker" reheated the article in the mouth of an empty pot, causing it to be idle. To avoid this and so increase production, small separate furnaces, known as "glory holes," came into being. Town gas is a natural choice for this purpose owing to its ease of control, rapid heating, cheapness of installation, small ground space, and independence of fuel storage. The size of the glory hole depends on the ware to be handled.

These furnaces, if open-fired, are the principal offenders on the score of bloom, and although muffle types have been designed by the Department and employed over long periods, yet those now at work will shortly be replaced, since the use of desulphurized gas removes the one objection to direct firing, which lends itself to intermittent working besides possessing simplicity of design and obvious economic advantages.

Recently there has been a development in furnace design employing a hot face lining of permeable refractory. Behind this lining there is a collecting space, into which the products of combustion are sucked through the permeable lining from the combustion chamber. In this way gases, otherwise leaving the furnace at a temperature in excess of that of the furnace, deposit a considerable quantity of heat in the lining, some of which is available for increasing the temperature of the furnace, keeping the gas consumption the same. Alternatively the gas consumption could be reduced so that the original temperature is maintained. We have built such a furnace for experimental purposes. The burner system is quite orthodox, air and gas being proportioned in a Keith Blackman No. 2 type mixer.

The experiment with this method of firing was prompted for two reasons—namely, the economy in gas consumption claimed for it, and the possibility of producing bloom-free ware when firing with ordinary town gas.

Experiments are as yet in an early stage, but it would appear that the permeable furnace is not only economical in gas consumption and attains its working temperature quickly, but its temperature appears to be remarkably stable, indicating that in spite of the short time taken to come up to temperature the heat is "solid" rather than "flash." The permeable lining, known as "Superfrac," appears to withstand the high temperature quite satisfactorily, the furnace having been up to 1,500°C. without any sign of failure. We are awaiting with interest the result of this furnace on actual glass working, the results given having been obtained on our own works. Results from glory-hole furnaces are difficult to correlate, since each individual works has its own ideas as to the size of the combustion chamber and the working temperature of the lining. To indicate the performances generally, the following are typical results obtained from—

A. Small furnace built by the Department (internal dimensions 11 in. dia. by 8½ in. long)—1 working hole.

B. Large furnace built by the Department (internal dimensions 16 in. dia. by 22 in. long)—2 working holes.

C. Furnace built outside the Department (internal dimensions, 11 in. dia. by 10 in. long)—2 working holes.

D. Permeable lined furnace (internal dimensions 15 in. dia. by 12 in. long)—2 working holes.

(Air pressure on eductor with ½ in. orifice, 3 lb./sq. in. Suction on eductor, 3 in. W.G.)

Remarks

It will be noted that the air pressure available on Furnace C was only 17 in. water gauge, which is largely responsible for the poor results obtained from it.

The permeable lined furnace (D) possesses a considerable advantage in thermal concentration over the others. With regard to the maintenance figures per sq. ft. of internal surface, it is of advantage to rearrange some of the figures as below, grouping temperatures and working hole ratios for comparison.

	Temp.	Thermal input.	W.H. ratio.		Temp.	Thermal input.	W.H. ratio.
A	1,280	29,070	3.38	B6	1,280	29,070	8.13
B4	1,260	25,660	5.39	D11	1,280	27,690	9.23
D3	1,290	17,170	3.57	D12	1,240	25,710	14.10
D5	1,230	22,540	6.51	D13	1,280	28,920	14.10
B5	1,140	22,230	5.39	A3	1,410	38,350	3.38
D4	1,140	17,280	6.51	D7	1,450	28,720	4.41

These figures speak for themselves, but it remains to be seen, however, whether the results from D are maintained over as long a period as are those from A and B.

TEMPERATURE RISE FROM COLD TO 1,220° C.

Burner system.	A. Wilkes ¾-in. air-gas mixture control and 2 in. fishtail nozzle.	B. Four British Furnaces, tunnel burners and air-gas mixture control.	C. Air supply to an orthodox air-blast burner is preheated by taking the pipe through the waste gas flue space.	D. Keith Blackman No. 2 type mixture control and orthodox A.B. burner.
Working holes	1–4½ in.	2–7 in.	2–7 in.	2–7 in.
Gas rate, cu.ft./hour	200	574	363	420
Temperature rise	15 m.–1,040°C.	12 m.–1,035°C.	17 m.– 800°C.	10 m.–1,010°C.
	22 –1,110°	20 –1,060°	28 – 920°	15 –1,150°
	30 –1,175°	25 –1,100°	36 –1,000°	20 –1,180°
	37 –1,220°	30 –1,135°	43 –1,050°	25 –1,220°
		35 –1,155°	52 –1,070°	
		41 –1,190°	60 –1.080°	
		47 –1,210°	No further rise	
		50 –1,220°		
Cons. to reach 1,220°C.	123.3	479	363	175
Concentrated thermal B.Th.U./cu.ft.	118,060	84,200	297,000	64,020

MAINTENANCE CONSUMPTIONS.

Furnace.	Int. dimensions and type of refractory.	No. and size of working holes.	Gas cons.	Maint. temp.	Maintenance B.Th.U./sq.ft. of int. surface per hour.	Percentage of working hole to int. area.	Air press. on burners.
A 1	11 in. diam. × 8½ in. long; 2 in. Sillimanite lining backed	1–4½ in.	210	1,280	29,070	3.38	1½ lb.
2	by 3 in. insulating brick	,,	220	1,320	30,460	,,	,,
3		,,	277	1,410	38,350	,,	,,
B 1	16 in. diam. × 22in. long; lining composed of 4½ in.	2–6 in.	570	1,340	25,450	3.89	,,
2	special Sillimanite blocks backed by 3 in. insulating	2–6½ ,,	565	1,310	25,400	4.60	,,
3	bricks	,,	571	1,320	25,660	,,	,,
4		2–7 ,,	567	1,260	25,660	5.39	,,
5		,,	491	1,140	22,230	,,	,,
6		2–8½ ,,	626	1,280	29,070	8.13	,,
C 1	11 in. diam. × 10 in. long; 4½ in. high alumina refractory	2–7 ,,	363	1,080	51,370	16.98	17 in.w.g.
2	lining backed by 3 in. insulating brick	2–6 ,,	320	1,140	43,240	11.71	,,
3		2–4½ ,,	264	1,220	33,940	6.28	,,
D 1	15 in. diam. × 12 in. long; "Superfrac" permeable lining	1–4½ ,,	230	1,320	16,500	1.8	1 lb.
2	backed by "Selfrac"	,,	340	1,420	24,400	,,	1½ ,,
3		2–4½ ,,	235	1,290	17,170	3.57	1 ,,
4		2–6 ,,	230	1,140	17,280	6.51	1 ,,
5		,,	300	1,230	22,540	,,	1½ ,,
6		,,	360	1,340	27,040	,,	2 ,,
7		1–7 ,,	390	1,450	28,720	4.41	2 ,,
8		2–7 ,,	260	1,100	20,000	9.23	1 ,,
9		,,	300	1,150	23,080	,,	1 ,,
10		,,	322	1,230	24,770	,,	1 ,,
11		,,	360	1,280	27,690	,,	1½ ,,
12		2–8½ ,,	320	1,240	25,710	14.10	1 ,,
13		,,	360	1,280	28,920	,,	1½ ,,

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(D) Annealing

The result of rapid cooling from a high temperature sets up strains due to the contraction of the glass. It is obvious that the whole cannot contract evenly due to varying glass thicknesses, shape, outer walls, low conductivity of most glasses, particularly lead, &c., so that the later contraction of certain parts sets up strain which can cause the article to crack or to fly into pieces. To remove these strains set up by the too rapid cooling of glass from the softened state annealing is carried out in furnaces known as "lehrs" or "kilns," the purpose being to anneal the ware after manufacture as quickly and as economically as is consistent with the degree of annealing that is considered desirable. Good annealing is vital; since at this stage the article is almost finished, so that the actual cash value of rejects is high.

For every glass there is (*a*) a lower annealing temperature where the rate of annealing is low and strains disappear very slowly, (*b*) an upper annealing temperature, which varies for different glasses and where annealing is rapid and no residual strain is possible. Thus the glass is heated to slightly below the upper annealing point and allowed to cool down slowly, the rate of cooling being equally as important as the correct temperature and being governed by the glass composition, thermal expansion curve, wall thickness, and shape of article.

Kilns consist of a brick chamber with single or double doors, usually heated by solid fuel, into which the glassware is packed until it is full. The door is closed and the temperature reduced by time limits until sufficiently cool to empty. This is a slow and uneconomical procedure, and has been replaced by continuous annealing in lehrs.

A lehr may be regarded as a long tunnel through which the ware is carried on an endless belt, the tunnel being heated in such a manner as to reproduce the required temperature gradient for correct annealing.

They are generally of two types: (*a*) open-fired, (*b*) muffle fired—competing fuels in this area being gas and electricity. Open-fired lehrs have a lower gas consumption than the muffle type, yet the latter are preferred at present in view of the difficulty of bloom, which occurs with the former, although the recent installations of desulphurizing plants which have taken place may cause this policy to be changed. Of lehrs in this area, all but two are fired by town gas.

It is very important to select the size of the lehr according to the particular purpose for which it is to be employed. Small lehr units having a conveyor a few inches wide fulfil certain requirements, whereas lehrs 100 ft. or more in length and 6 ft. or more in width are comparatively common for use in other sections of the glass industry. Some glassware requires, even commercially, 30 to 36 hours' annealing time (there are the classic examples of telescope reflector lenses requiring many months for annealing) down to very light glassware requiring under a minute. The temperature of the glass when inserted in the lehr plays a very important part in the operation and upon the fuel consumption. Gas-fired lehrs under conditions where the glassware is hot, and in the small size units, often require less than 100 cu.ft. of gas per hour. It is to be realized that, for example, the annealing temperature of lead glass may be under 500°C., but the annealing temperature of heat-resisting glasses, which are now becoming more commonly used for domestic articles, is sometimes over 700°C. Owing to the special characteristics of this type of glass it is not always necessary for it to be immediately placed into an annealing lehr, with the result that it is often introduced into the lehr cold and consequently affects the fuel consumption.

In Stourbridge the lehrs are rather similar because they have to a great extent similar work or the same ranges of glass to deal with. The annealing time is usually between 2½ and 6 hours, depending on the type of ware and heat input, while gas consumption may vary between 450 and 650 cu.ft. per hour.

The "Amco" lehr, a number of which are at work in this district, is a continuous operating unit—that it to say, the conveyor carrying the glass which is to be annealed is in constant motion, but the temperature curve within the tunnel of the lehr is static, and can be preselected according to the type of glassware. An infinitely variable gear is used for obtaining a wide range of speeds. The "Amco" lehr uses a woven wire conveyor of a special character, which is extremely strong and light, thus interfering as little as possible with the static temperature curve. As this conveyor has to be heated in addition to any additional heat that the glass itself may require, its lightweight character will be appreciated from the point of view of economy also.

The main burners for heating the furnace (the gas to which is preferably automatically controlled) fire directly from the charging end into a muffle combustion chamber situated below the conveyor. The products of combustion are taken off at various points to the main waste gas flue. A number of gas-fired radiants are provided near the charging door, recessed into the side of the annealing chamber in order to counteract by direct heating the door losses, by creating a little extra pressure in the lehr and so reducing the possibility of draughts. They are also useful for keeping the lehr warm and bringing it up to temperature economically.

(E) Cracking Off, and Edge Fusion

Some articles—*e.g.*, tumblers—are blown in a mould, and after being cracked off the blowing iron are placed in the lehr. After annealing it is necessary therefore to crack off the top at the requisite height from the base. For thin-walled articles—*e.g.*, tumblers and wine glasses—the method is simple and very effective. It usually consists simply of three iron tables, the outer two being rotated mechanically and the middle one by hand. Against each table is an iron rod, attached to which, at the height at which the article is to be cracked off, is a diamond on the centre pillar and a burner utilizing four very fine flames on the outer ones. The article is placed on the centre table, and is rotated by hand to allow the diamond to give a cut all round. It is then transferred to one of the outer tables, when the gas flames play on the cut, so that the sudden expansion causes the glass to spring apart in an even fracture. While this is taking place another article has been cut and placed on the other rotating table.

Thick-walled processed articles may be done in a similar manner, but with hand-made ware the unwanted portion is sheared after reheating in a glory hole.

Although the cracking-off process leaves an even edge, yet it is ragged and requires smoothing. The rim is "stoned" primarily on a natural or manufactured wheel and left perfectly even and smooth. The articles are then passed through the edge fusion process, which is carried out on a machine designed so that the articles are placed by the operator on a number of revolving tables arranged in the form of a circle, at one point on the circumference of which a set of burners of the Marshall or Bournkessel type fire on to the rims. The burners are so situated that the products of combustion pass into a tunnel, and thus accomplish some degree of preheating on the ware moving into position. The machine is adjustable, enabling articles of any height to be handled. Care must be taken to ensure that the temperature of the lower portion of the article is maintained below its softening point, else deformation may be set up.

Home-Made Desulphurizing Plant

As a result of this process both reduction and reaction films may be found on the article, depending on its composition. The former can be avoided by adjusting the air-gas ratio and softening the rims in an oxidizing atmosphere. Bloom due to sulphur compounds, however, is only to be avoided by using desulphurized gas. To prove this the Department constructed a simple sulphur removal plant using charcoal as the medium. This proved very satisfactory, being in continuous use on edge fusion for 18 months, when it was replaced by a catalytic plant designed to treat gas for glory holes and lehr radiants in addition. It is still maintained as standby for this plant.

The plant consists of two cylinders, one 20 in. and one 16 in. diameter, containing four perforated grids on which the charcoal rests. There was no reason for varying the diameters except to use the material which we had to hand. The gas passes downwards through the charcoal bed and out at the base. When the charcoal is foul it is regenerated by hot air, which is heated in an outside chamber by passing through a coil made of standard fittings below which is a burner. The air-operated safety valve controlling the gas to the burner consists of an ordinary ¾ in. gas governor on which the body is separated from the valve with two brackets, while a spring is inserted below the diaphragm. Air on top of the diaphragm keeps the valve open, and in the event of a failure the valve closes to leave a small by-pass flame. If this was not incorporated the coil would get red hot, and when the air supply was restored would cause the very hot air in the coil to pass forward to the charcoal and probably cause it to fire. Thermostats are provided at the top and bottom of the charcoal chamber, being set at 90°C. and 100°C. respectively,a nd also on the air line (set at 140°C.), while four dial thermometers mounted on a panel indicate the temperatures at these points. The time taken for regeneration, with an air pressure of 8 in. W.G., was about 8 hours with the 20 in. and 6 hours with the 16 in. cylinder. The 20 in. cylinder contains approximately 2 cwt. of charcoal and the 16 in. 1¾ cwt. The average amount treated before regeneration was necessary was about 20,000 cu.ft., which represents about four or five weeks' working, although if special charcoal had been purchased for the job instead of ordinary industrial wood charcoal as was used, this figure would no doubt have been very much improved upon. It is regretted that due to labour problems tests for sulphur compounds on the inlet and outlet of the plant were not carried out, but suffice it to say that the ware was entirely satisfactory.

(F) Re-Annealing

After the edges have been glazed the ware is again re-annealed in order to remove any strains which may have been set up as a result of the process. The articles are loaded into a small lehr, about 45 ft. long, 18 in. wide and 10 in. high, after passing through which the processing of plain ware is complete.

(G) Decorating and Acid Polishing

Few types of glasses other than lead crystal are cut, due to their inferior appearance and the difficulty of acid polishing afterwards. The bare outline of the design is first marked out in the glass with a special pen, or brush, using marking ink made of red lead and turpentine. The deeper facets are cut by holding the ware against a carborundum wheel, or alternatively a mild steel wheel over which runs a trickle of sand and water. The surface of the cut is rather rough and opaque, and this is smoothed over and the finer facets cut by

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the use of a manufactured or quarried smoothing wheel. It will be observed here that the surface after smoothing is very much finer than in the case of the roughing process. It is now necessary to give the article its final polish, which is done by acid washing.

The ware is immersed into a mixture of hydrofluoric and sulphuric acids, which are maintained at a constant temperature. Two or three immersions in the acid each followed by washing in hot water may be necessary. The purpose of acid polishing is to dissolve a thin film of glass from the surface of the article.

The article is now ready for its final inspection and packing to the purchaser.

Coal Tar Fuels*

By E. BRETT DAVIES

Most of the substances obtained from coal tar are only a small proportion of the original raw material, and some 70 to 80% of the products of the distillation of crude tar are pitch, together with creosote and other tar oils. There are many industrial uses for this large bulk of material, either collectively as refined tars or similar substances, or individually as pitch and oils, and it is towards the use of these products for fuel purposes that our attention is now directed.

In passing, two indirect fuel derivatives from coal tar might be noted. The first, a very high-grade "motor spirit" for internal combustion engines, is made by hydrogenating creosote. The second, pitch coke, is made by the carbonization of medium soft pitch in specially designed stills or ovens. Pitch coke may be regarded as the ultimate residuum from the total destructive distillation of crude tar. It consists largely of carbon, and is produced in comparatively small quantities in this country for the manufacture of carbon electrodes.

Hard Pitch

Hard pitch is the first commonly used coal tar fuel to be considered. This fuel is made by continuing the tar distillation beyond the point at which normal medium soft pitch is produced. An additional 15% to 20% of oil is separated as the softening point of the pitch increases from 70°C. to 100°C.† or more. This latter figure, as a general rule, may be regarded as a minimum for hard pitch fuel for pulverizing purposes. This fuel normally contains less than 1% of ash, less than 1% of sulphur, and has a calorific value of approximately 16,000 B.Th.U. per lb. It has no inherent moisture content, and neither does it deteriorate in stock nor is it liable to spontaneous combustion. Hard pitch may be transported and handled with the same facility as other solid fuels, but because it is liable to soften at temperatures approaching 100°C., the methods of applying the fuel call for special precautions. When correctly applied it is found to be an ideal powdered fuel, and when compared with other pulverized fuel practice, one of the outstanding features is the lack of wear on mills and other handling plant.

Liquid Coal Tar Fuels

The most commonly used coal tar fuels are those which are applied in liquid form. These fuels range from medium soft pitch which is normally solid at atmospheric temperatures and has a softening point of 70°C. to light creosote oil which is liquid in normal circumstances. This range covers intermediate products such as the well-known "Creosote/pitch mixture." The name "Creosote/pitch mixture" is perhaps rather an unfortunate choice, since it conveys the impression that this and other similar fuels are actually compounded from proportions of the named constituents. Moreover, while only one general grade of Creosote/pitch mixture is at present in common use, there are other grades, and the name gives no indication of the composition or viscosity of the fuel. These fuels are all perfectly homogeneous products produced to strict viscosity specifications, and while they naturally contain varying proportions of creosote and pitch, they are not normally made by mixing together these two elementary constituents, but are generally prepared either by distilling the lighter fractions from the crude tar until the fuel, which remains in the still, has the required viscosity, or by taking a fairly viscous tar base and adding oil to it to produce the correct viscosity fuel.

In its recent publication, *Coal Tar Fuels*, the Association of Tar Distillers has published specifications for a complete range of coal tar fuels and has introduced a new system of nomenclature based upon viscosity. It is generally accepted that for ordinary purposes a viscosity equivalent to 100 seconds Redwood No. 1 is desirable at the point of atomization of a liquid fuel. By incorporating the temperature at which the fuel attains this viscosity into the name of each fuel a simple and distinctive grading is produced. Thus light creosote which is liquid and may be atomized at atmospheric temperature is called "Coal Tar Fuel 50," while medium soft pitch for liquid fuel purposes becomes "Coal Tar Fuel 400," since it is at 400°F. that its viscosity is approximately 100 Redwood No. 1. Tabulating the whole range of Coal Tar Fuels:

TABLE I.

C.T.F. 50	A light oil similar to grade "A" creosote.
C.T.F. 100	A creosote oil similar to grade "B" creosote.
C.T.F. 200	The tar fuel now commonly known as C/P mixture.
C.T.F. 250	These are two heavier grades of tar fuel particularly
C.T.F. 300	suitable for heavy metallurgical purposes.
C.T.F. 400	A standardized grade of medium soft pitch fuel.

As might be expected, the calorific values of these fuels range from the maximum value for the true oils containing the highest hydrogen content down to C.T.F. 400, which shows the lowest hydrogen content. Differences, however, are not very great, as may be seen from the following tabulation, from which the properties of the intermediate fuels may be interpolated*:

TABLE II.—TYPICAL ULTIMATE ANALYSES PERCENTAGES.

	C.T.F. 100.	C.T.F. 400.
Ash	Trace	0.13
Carbon	89.30	90.42
Hydrogen	6.90	5.23
Sulphur	0.13	0.65
Nitrogen	0.84	1.38
Oxygen (by difference)	2.83	2.19
Calorific value	17,050 B.Th.U.	16,240 B.Th.U./lb.

C.T.F. 400 may be transported and stocked as a solid fuel and subsequently melted and heated up before use. In common with the other fuels, it may also be transported from producer to consumer as a liquid. The transport and subsequent handling of all the coal tar fuels and their atomization is entirely analogous in method to other liquid fuel practice. Due regard must be given to the viscosity characteristics of the fuel in use, and at the same time care must be exercised to avoid the possibilities of sedimentation and/or gassing if the fuels are overheated.

For general purposes, 5,000 seconds Redwood No. 1 is usually accepted as the viscosity limit at which a liquid fuel may be handled by consumers' pumps, and, except for special applications, 100 seconds Redwood No. 1 may be taken as a convenient viscosity for atomization by standard types of fuel burners. These two criteria fall within the ranges given in the following table, although the figures therein should only be used as a guide, and in specific instances special provision may have to be made for atomization or handling to be performed outside the ranges indicated.

TABLE III.

	A. Transport and pumping temperature, °F.	B. Atomization temperature, °F.
C.T.F. 50	Atmospheric	Atmospheric
C.T.F. 100	80 to 120	100 to 120
C.T.F. 200	80 to 100	180 to 200
C.T.F. 250	130 to 160	240 to 260
C.T.F. 300	170 to 200	280 to 310
C.T.F. 400	270 to 310	370 to 400

Because it is difficult, and in many cases practically impossible, accurately to control the temperature, and consequently the viscosity of small feeds of the more viscous fuels, it has been found possible in practice to make a rough classification of the types of fuel suitable for burners of various capacities. There are no definite limits in this connexion, as much depends on the degree of elaboration of each particular plant, but the following table may be useful as a general guide:

TABLE IV.

C.T.F. 400	Suitable for burners of not less than 10 G.P.H.
C.T.F. 300	Suitable for burners of not less than 5 G.P.H.
C.T.F. 250	Suitable for burners of not less than 1 G.P.H.
C.T.F. 200	
C.T.F. 100	Suitable for fractional G.P.H. burners.
C.T.F. 50	

Again, depending upon the viscosity/temperature characteristic, certain types of burners have not been found suitable for the more viscous fuels. Thus for C.T. Fuels 50 to 250 inclusive practically all types of burners may be employed, but for fuels 300 and 400 only pre-heated high-pressure air or steam atomizers have been successfully applied. It has been claimed that these latter two fuels may also be atomized with mechanical atomizers, but much more experience is necessary before this procedure can be safely recommended.

* From a Paper to the Institute of Fuel (Yorkshire Section).

† The softening point temperatures are those determined by the method of Kraemer and Sarnow. It should be noted that the softening point is only an indication and not an absolute measure of grindability.

* These figures are taken from *Coal Tar Fuels*, by J. S. Sach, Association of Tar Distillers, 166, Piccadilly, London, W.1.

Delanium, Ltd., Imperial House, 82–86, Regent Street, W. 1, has been registered as a private company, according to *Jordan's Daily Register*, "to undertake a research into the production from coal, oil, and other materials of substances of commercial and industrial value." The nominal capital is £50,000 in £1 shares. The Directors are Mr. B. C. Westall (Chairman, Thomas De La Rue & Co.); Messrs. C. G. R. Ashton and H. P. Bridge (Directors, De La Rue Plastics, Ltd.); Mr. E. L. Hann (Director, Powell Duffryn, Ltd.); Mr. J. G. Bennett (Director, C. D. Patents, Ltd.); and Mr. H. V. Vale (Director, Cory Brothers & Co.).

Coal Tar as a Source of Organic Chemicals*

By D. W. MILNER

COAL tar was, until recently, the only indigenous source of hydrocarbons in this country, and for the last century, chemical manufacturers have been relying upon this source for most of their organic chemicals with an aromatic structure. Since the time of Perkins' "Mauveine" chemists have continued to isolated more and more pure products from coal tar and place them at the disposal of the chemical industry. Complaints are made from time to time in the Technical Press that the coal-tar industry is backward, and has not progressed at anything like the speed of the American petroleum industry. This was probably true in the past, and the reason is obvious. Until recent years the distillation of coal tar was carried on by numbers of small distillers. There was keen competition among these distillers to obtain sufficient tar to keep their plants working 12 months in the year. These small plants with small throughputs could not afford to install costly refining plant, as the source of tar was never assured. To-day the distillation of tar is carried on mainly by large groups and the quantity of tar is more or less assured. Because of this, large continuous tar stills have been and are being erected. More costly refining plants, many of a continuous type, are being used to deal with the intermediate stages of the tar-distillation process, and chemicals are being extracted from coal tar in these large plants that were almost unknown in the days of the batch tar still. Another disadvantage of the tar industry, as against the petroleum distillers, is the fact that coal tar varies considerably from source to source, coke oven, horizontal retorts, and vertical retorts even in the same district. On the other hand, crude oil does not usually vary much in composition in the same district.

Composition of Coal Tar

The next point to deal with, I think, is the composition of coal tar. This varies considerably from different sources, but to illustrate my point I have chosen an analysis made some time ago by Weiss and Downs of a coke-oven tar. The percentages are given on a sample of dry tar.

COMPOSITION OF COKE-OVEN COAL TAR.

	%
Crude benzole and toluole	0.3
Xylenes, cumenes and isomers	1.1
Indene, coumorone, &c.	0.6
Naphthalene	10.9
Alpha methyl naphthalene	1.0
Beta methyl naphthalene	1.5
Oils in naphthalene and the methyl naphthalene range	1.7
Dimethyl naphthalenes	3.4
Acenaphthene	1.4
Oils in acenaphthene range	1.0
Fluorene	1.6
Oils in fluorene range	1.2
Anthracene	1.1
Phenanthrene	4.0
Carbazole and similar compounds	2.3
Oils in the above range	5.4
Phenol	0.7
Cresols and xylenols	1.5
Tar bases, pyridine, &c.	2.3
Pitch oils and greases	7.0
Pitch	50.0

This analysis by Weiss and Downs is taken as a typical example.

By far the largest single component in the list is naphthalene; this was partially extracted in the past for the production of naphthols, &c., for the colour industries, but most of the naphthalene in coal tar was used as fuel. This position is certain to be changed, as naphthalene will be in greater demand in its partially burnt form of phthalic anhydride for the manufacture of plastics, glyptals, &c., if the American chemical industry is any guide.

Of the other hydrocarbons, benzene and toluene have been used in industry; although motor fuel has been a strong competitor, this may not be so after the war if tax adjustments are made, as both these hydrocarbons will be in more demand for synthetic processes such as phenol from benzene. The amount of phenol in coal tar will not meet the demand for this material and synthetic phenol will be made, benzene being the obvious starting material. I shall revert to the uses of phenol later in this Paper. The xylenes and cumenes have only had limited uses in industry, except as solvents, but when these materials become available as pure products they will provide more raw materials for industry. O-xylene is already available in limited quantity, and this quantity could, no doubt, be increased if the demand increased.

I do not want to bore you with too many figures, but using the pre-war figures for the coal tar industry, nearly 2 million tons of tar were produced in this country in 1938. If this figure is used in conjunction with the table, it will be seen that 0.1% represents 2,000 tons, or approximately 400,000 gallons. Thus, it will be seen that chemicals occurring in coal tar in only small percentages, if these can be extracted, will provide large amounts of chemicals for the chemical industry. At the same time there should be quite a large percentage of material for which industry can find no use that Mr. Brett-Davies can use for pyrotechnical purposes.

Of the higher hydrocarbons, anthracene is largely used in the dyeing industry, and has been used for many years; other less available hydrocarbons are now being put on the market such as acenaphthene and fluorene. These substances are being used in industry for colour manufacture. There are other hydrocarbons occurring to a lesser degree in coal tar that time will not permit me to mention, such as the methyl naphthalenes. Some of these are being asked for by the chemical industry, and the present limited demand may increase as normal conditions return to the industry. Before leaving the hydrocarbons, mention should be made of one or two of the unsaturated hydrocarbons that are being used by the chemical industry. Perhaps the most important at present is indene. This hydrocarbon is not usually extracted as such, but is polymerized in the naphtha in which it occurs, and the polymerized indene resin is sold as such, mainly for use in the paint and varnish and the plastics industries. Different methods of polymerization give widely different resins, the main points being the pale colour and high melting-point. Some of the softer resins have also been used as tackifiers for rubber, especially the synthetic variety.

Mention of synthetic rubber brings me to another unsaturated hydrocarbon which is being synthesized and used in large quantities in the U.S.A. for the manufacture of Buna-S. This is styrene; it occurs in coal tar, but owing to the difficulty of extraction, it has not been heard of much in the coal-tar industry. With present methods of extraction it is probably cheaper to synthesize it from benzene and ethylene; more so in the States, where ethylene is available from the cracking plants. Dr. Coulson, of the D.S.I.R., has recently taken out a patent for the recovery of this material from crude solvent naphtha by an azetropic method, using ethylene glycol monomethyl ether as the azetropic liquid.

Styrene is in demand by the chemical industry as its polymers have valuable electrical properties. The resin is of no use to the paint and varnish trade owing to its poor solubility in the oils used in paint manufacture.

Dicyclopentadiene is another unsaturated hydrocarbon extracted from coal tar which is now available to the chemical industry, and the material is at present being examined from many sides, such as paint, rubber, &c. It has also been examined as a source of cyclopentadiene, which has been shown in America to be an excellent anti-knock agent in motor fuel. This material is easily made from dicyclopentadiene by depolymerization to the monomer, and final hydrogenation.

In that résumé of the hydrocarbons available to the chemical industry the whole story has not been told, but sufficient I hope to hint that in the future less and less of the coal-tar hydrocarbons will be available for fuel. For the present, chemical industry will pick out those substances it requires and the remainder will be available for fuel purposes. If at some future date catalysts are discovered which will break down the more complex aromatics to simpler ones, a process widely used with the paraffinic hydrocarbons, the story will have quite a different ending.

Coal-Tar Products

I should like now to turn to coal-tar products which it is quite safe to assume no member of this society would desire to use as fuels—*i.e.*, coal-tar phenols and coal-tar bases. Perhaps a good reason for this healthy desire is the price of these materials, 3s. to 4s. per gallon for phenols, and a good deal more for the bases.

Although these products occur only to the extent of a few per cent. in coal tar, on the previous calculation the total available is probably over 100,000 tons per annum of phenols, and probably over 40,000 tons per annum of bases. If these figures are taken into account along with the price standard it will be seen that these products are a most valuable part of coal tar.

Dealing with the phenols first, the most important is phenol itself.

Phenol

Originally, this material was extracted from coal tar to be used as a disinfectant or antiseptic, but to-day very little is used for this purpose—and certainly very little in wartime. Better and less toxic materials are available, most of them from coal tar. During the last war the chief demand was for picric acid as a high explosive, and large synthetic phenol plants were used to manufacture phenol from benzene. In this war very little phenol is used for the manufacture of explosives, and its chief use is for the manufacture of thermoplastic materials in conjunction with formaldehyde—or other aldehydes. Phenol is still considered to be the best material from which to make

* Paper to Yorkshire Section of the Institute of Fuel.

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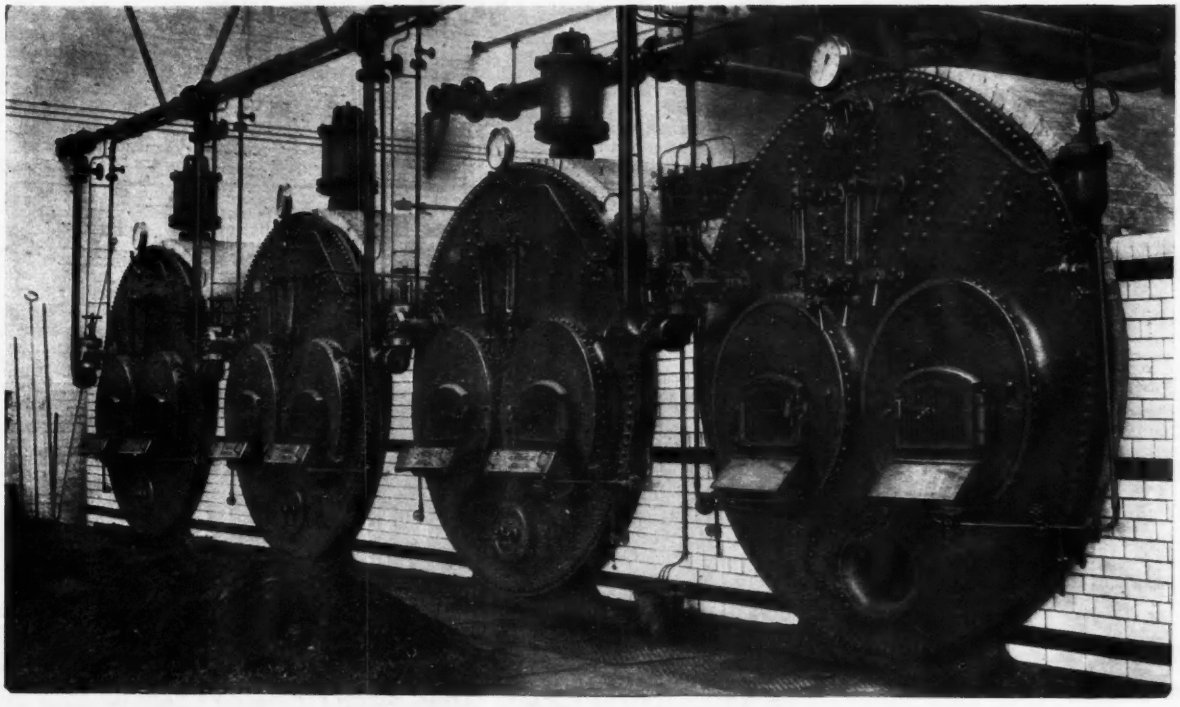

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bakelite materials. It is certain that in the future the phenol production from coal tar will not be sufficient to meet the demand, and synthetic phenol will have to be made from benzene. Phenol is also hydrogenated to produce cyclohexanol and cyclohexanone. Cyclohexanol and cyclohexanone are used as the starting materials for the manufacture of adipic acid, which is one of the components of the new plastic nylon. They are also in demand as solvents.

Cresols

Ortho-cresol, the lowest boiling isomer, is not favoured by the plastic manufacturers, if one judges from the latest specifications. The reason is rather obscure, but one gathers that the final reaction in the hot-pressing stage is rather slow, and as this is usually the bottle-neck in the production of moulded articles, anything which delays this stage is not helpful. It is used, however, in the manufacture of tricresyl phosphate, largely used as a plasticizer, and a certain amount is being used to make D.N.C. dinitro-ortho-cresol, used as an insecticide. Ortho-cresol or cresol mixtures rich in ortho-cresol were used at one time as inhibitors in motor spirit, but I gather that better materials have now been found to replace these.

Meta and Para-cresols

These two isomers boil at about the same temperature, and have only been separated commercially by chemical methods. The mixture, however, is used as such for a variety of plastics, and for some purposes is preferred to pure phenol. The meta-isomer predominates, and this material reacts very quickly in the formaldehyde process, so that the presence of the para-cresol helps to tone down the speed of reaction.

The cresols are widely used in the manufacture of lysol type disinfectants, all the three isomers being useful for this purpose. The pre-war carbolic soap was also responsible for the use of large quantities of cresols, but during wartime, and probably in the post-war period, the cheaper xylenols have been substituted.

Xylenols

As has been stated, mixtures of these dimethyl phenols are largely used as disinfectants; they are not so caustic as the cresols, and are probably quite as good for disinfectant purposes.

The mixed xylenols are also used in the manufacture of oil-soluble resins. Of the pure xylenols extracted from coal tar, the most important is the 1 . 3 . 5 isomer. This material is the most reactive of the phenols in the formaldehyde reaction, and usually has to be diluted before being processed.

It is also in demand for the manufacture of para-chloro meta xylenol, the active principle in antiseptics of the Dettol type. Another xylenol that has had a limited demand is the ortho-4-xylenol. This has been used as the starting material for the manufacture of Riboflavine vitamin B_2. For the other xylenols, so far, the chemical industry has not made many demands; an interesting point is that the meta-4-xylenol is used for the identification of nitrates, and can be used to estimate them quantitatively.

The higher boiling tar-phenols are largely used for the manufacture of disinfectant fluids of the Izal type, sheep dips, &c.

The phenols generally are good solvents, and are used in some industries for this purpose.

Coal-Tar Bases

Twenty-five years ago the main use for tar bases was as a denaturing agent for alcohol.

Two grades were used based on two German specifications, the O.G.S. 90/140° and the N.G.S. 90/160°. The figures refer to the distillation range of the material. Any residues left from the above materials were usually dumped into creosote.

The demand for pure pyridine changed this method of dealing with tar bases.

Pure pyridine is used in some textile treatments, and in some processes of rayon manufacture. There is also a certain demand for the manufacture of the new sylpha-pyridine drugs. A certain quantity is also hydrogenated to piperidine, which is used in the manufacture of rubber accelerators. It is a very powerful solvent, but its strong odour is rather a deterrent to its use in this direction.

With the demand for pure pyridine the methyl pyridines were investigated by the coal-tar industry, and quite recently the picolines have been made available to the chemical industry. The separation of the picolines was encouraged by the demand for 3-picoline as the starting-point for the manufacture of nicotinic acid, one of the B-class vitamins. This material was first separated on a commercial scale in this country in Yorkshire, and most of the present make, after suitable oxidation, finds its way into our daily bread.

The 2-picoline and 4-picoline are also available to industry, although their uses have hardly had the necessary time for development yet.

The lutidines, dimethyl pyridines are used chiefly as special solvents, being largely used in the mixed state in the purification of crude anthracene.

The higher boiling collidines are also used for this purpose.

The tertiary pyridine bases are also used in certain organic reactions for the removal of hydrochloric acid from an organic molecule.

Among the higher boiling-tar bases are found the primary aromatic amines, aniline, the toluidines and the xylidines. Some of these can be extracted in a pure state, and their uses in industry are obvious.

In the case of the toluidines, it is interesting to note that when prepared from toluene by nitration and reduction the meta-isomer is only present in small quantity, whereas in the toluidines extracted from coal tar the meta isomer predominates.

Of the higher boiling substances allied to the bases is carbazole. This substance has been used to a small extent as an intermediate for dyestuffs, but the demand is so far only very slight.

Sulphur Compounds

Sulphur compounds, including hydrogen sulphide, are present in coal tar to an appreciable extent. They usually occur as impurities, very difficult to remove, in the otherwise pure products from coal tar —*i.e.*, thiophen in benzene. Usually the tar distiller is only concerned with their removal or destruction. Very few have been extracted for commercial purposes. Carbon bisulphide is one exception. This substance occurs in crude benzole, and is largely extracted in this country by means of the ammonium polysulphide process, a patent held by the Y.T.D.

The material, which can be extracted chemically pure, is mainly used as a solvent and in the manufacture of carbon tetrachloride. It also forms the basis of several rubber accelerators.

Finally, one organic chemical element, mercury, is recovered from coal tar. This was first reported, I think, by W. Kirby. This is another product which only made its appearance when continuous tar stills were put into operation, as the actual percentage in tar is very small.

In this short Paper the emphasis has not been laid on the proportions of either bulk or value of the various products. Its aim has been to show in a qualitative way the many-sided contact made by the coal-tar industry with the chemical industry rather than deal with the quantitative statistical side. Perhaps that is as it should be in wartime, when statistics are suppressed and the true facts are difficult to obtain.

I hope that it has indicated the extent of the void that would be created in the chemical industry should we turn over, as has been suggested, to the complete gasification of coal.

Up to the Beginning of January the Stockport Gas Department have supplied 12¼ million cu.ft. of gas to the Manchester Gas Undertaking for transmission to Salford.

The Paramount Film of the Northolt houses, including shots of the gas and gas-and-coke houses, was in the programme at all the London West End theatres taking the Paramount service, in suburban Odeons, and in the leading provincial towns, from Jan. 4 to Jan. 7, and in other provincial towns from Jan. 8 to Jan. 10, and was shown in a number of small towns and small seaside resorts from Jan. 11 to Jan. 14. It is estimated that the film will have been seen by eight million people

The 1945 Edition of the *Ironmonger Diary and Hardware Buyers' Guide* is the 77th of its kind. Although still in its "utility" page size it provides the retailer with a concise summary of all the wartime legislation affecting his business, including price control, limitation of supplies, pay as you earn income tax, prohibitions, re-sale restrictions, and war damage insurance. The diary is neatly sandwiched between the directory section and the displayed advertisements, which in themselves again reflect the optimism that prevails in a trade which has been severely handicapped by the war.

A Town Planning Exhibition was recently held at Bedford, the outcome of work of the Bedford Council of Social Service. and the United Kingdom Gas Corporation contributed a model kitchen to the exhibition. The exhibit showed hot-water supply and heating by a slow combustion coke stove, which in addition to three radiators serves an airing cupboard and bathroom towel-rail. A central duct contains all flue pipes and plumbing work. The Housing Committee of the Council of Social Service are also concerned with the modernizing of old houses, and are considering the replacement of obsolete kitchen ranges by coke-burning equipment providing both hot water and space heating.

Mr. W. Allison Davies, Borough Treasurer of Preston, has again rendered a very useful service to all interested in local government in producing *Rates Levied in Various Towns, 1944–45*, together with charges for gas and water supplies. It is the 60th Annual Statement of its kind, and is framed with the object of showing the actual rate levied in various towns, and the extent to which they have been increased or reduced by municipal undertakings and estates. Although there has recently been some relaxation of the security ban on the publication of information concerning certain aspects of local government and some utility services, the statement is still in its wartime form. Rates showed a slight but all-round average increase during the year, county boroughs rising by three farthings to 14s. 9½d., selected boroughs by 2d. to 13s. 9⅜d., and selected urban districts by a fraction over a penny to 15s. 3½d. The most heavily rated area was Merthyr Tydfil (29s. in the £), and Bournemouth was at the bottom of the list with a rate of only 8s. According to the statement, Middlesbrough had the cheapest domestic gas (2s. 2½d. per thousand cu.ft), and Broadstairs had the dearest (8s. 4d. per thousand cu.ft.).

GAS PRODUCTS PRICES—STOCKS AND SHARES

The London Market Jan. 29.

There are no changes to report in the prices of Coal Tar Products.

A Government Order came into effect on March 1 controlling the price of Benzole and Coal Spirit and replacing the Control of Coal Tar Naphtha and Xylole Order, 1943.

The Order is known as the Control of Benzole and Coal Spirit Order, 1944 (S.R. & O. 1944, No. 172).*

By this Order the price of Motor Benzole is fixed at 2s. per gallon. The Order also lays down the method of evaluating Crude Benzole.

The Order also calls for periodical returns to the Ministry of Fuel and Power from all producers of Crude and Refined Benzole.

In connexion with the Coal Tar products market, the Government Order designated the Contol of Toluene (No. 4) Order, 1944 (S. R. & O. 1944, No. 170), contains an amendment of the Control of Toluene (No. 3) Order, 1943.

Attention is called to a new Government Order, which amends the price of Toluene as from Sept. 1, 1944. The Order is entitled, The Control of Benzole and Coal Spirit (No. 2) Order, 1944 (S. R. & O., No. 988).

The only change in connexion with the prices of Coal Tar Products refers to Naphthalene. A new Government Order, entitled the Coal Tar Products Prices (No. 2) Order, 1944 (S. R. & O. 1944, No. 1051), allows increases in the maximum prices for all forms of Naphthalene. The new Order came into force on Sept. 22, 1944.

* Slightly amended by Control of Benzole and Coal Spirit (No. 2) Order, 1944, which amendments came into force on Oct. 1.

The Provinces Jan. 29.

The average prices of gas-works products during the week were: Pitch and Crude Tar,* Toluole, naked, North, 90's, 2s. to 2s. 2½d., pure, 2s. 9d. (now controlled by S. R. & O. 1944, No. 988, operative from Sept. 1, 1944. Benzole and Coal Spirit, also Coal Tar Naphtha and Xylole, are now controlled by the Control of Benzole and Coal Spirit Order, 1944, dated Feb. 18, 1944, S. R. & O. 1944, No. 172, operative from March 1, and S. R. & O. 1944, No. 988, part 1, operative from Oct. 1, 1944. Carbolic acid, 60's, anthracene, creosote oil (hydrogenation), coal tar oils (timber preservation, &c.), and strained anthracene oil controlled by the Coal Tar Products Prices Order, 1943, dated Oct. 20, 1943 (S. R. & O. 1943. No. 1528), operative from Nov. 15, 1943, Naphthalene now controlled under S. R. & O. 1944, No. 1051, operative from Sept. 22, 1944.

* In regard to pitch and crude tar prices we would ask readers to refer to the editorial note on p. 396 of the "JOURNAL" for Sept. 10, 1941.

Scotland Jan. 27.

Inquiries are, if anything, more numerous and prices are unchanged. Refined tar*: Yield to Distillers is 4½d. per gallon *ex* Works, naked. Creosote oil: Timber preserving quality,* 5½d. to 6½d.; hydrogenation oil,* 5⅞d.; low gravity or virgin oil,† 7½d. to 7¾d.; benzole absorbing oil,* 6½d. to 8d. per gallon. Refined cresylic acid* is 3s. 6d. to 4s. 6d. per gallon *ex* Works, naked, according to quality. Crude naphtha†: 6½d. to 7d. per gallon. Solvent naphtha*: Basic prices delivered in bulk, 90/160 grade, 2s. 8d., and 90/190 Heavy naphtha, Unrectified, 1s. 10½d.: Rectified, 2s. 2d. per gallon. Pyridine†: 90/160 grade, 13s., and 90/140 grade, 15s. per gallon.

* Price controlled. † Uncontrolled.

The week opened with a reaction in industrial equities and a consequent strength in gilt-edged stocks. Later the reaction was halted and towards the close prices began to harden, while here and there several good features were recorded. Home rails met with a little more enquiry, and, where changed, quotations improved.

There was only a small volume of business in the Gas Market, but all prices were maintained and the few changes were in an upward direction. A feature was the sharp rise in Portsmouth consolidated, which under enquiry closed 7 points higher at 137½. Dividend announcements included South Suburban, which is distributing a final of 2½%, making 5% (the same) for the year, but Commercial again pays no dividend on its ordinary or preference stocks.

The following were the changes in price during the week:

OFFICIAL LIST

Gas Consolidation "A" Ord. ...	22/—23/-	+-/6d.
Gas Light 3½ p.c. max.	81—84	+1
Portsmouth Cons.	135—140	+7
South Metropolitan Ord.	93—96	+1
United Kingdom Ord.	20/—23/-	+-/3d.
Ditto 4½ p.c. 1st Cum. Pref. ...	22/—24/-	+-/6d.
Ditto 4½ p.c. 2nd Non-Cum. Pref...	17/6—19/6	+-/6d.

PROVINCIAL EXCHANGE

Bristol 5 p.c. max.	119—121	+1

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"LYNDON" and "EGA-KUT"
SCREWING TOOLS;
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GASHOLDERS of all types; BOILERS, PIPES, TANKS, &c.

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Gas Flow Recorders and Indicators
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Makers of Gas-Works Plant of all descriptions.

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Vertical and Inclined Single Column Gauges for water, oil and mercury filling. Pressure and Flow Indicators and Recorders; Controls and Special Devices.

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TULLY GAS PLANT
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ONE STAGE GASIFICATION OF COAL

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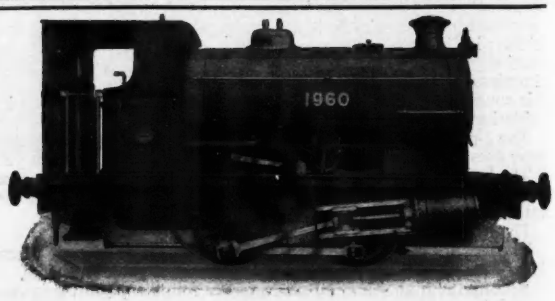

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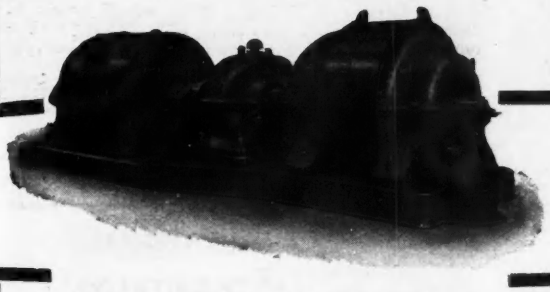

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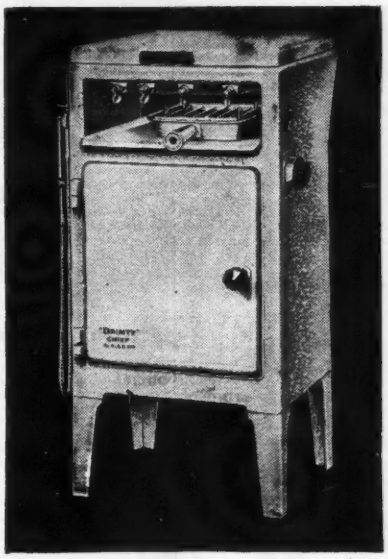
The DAINTY Chief



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Minimum Costs, Highest Efficiency
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GAS RETORTS in BEST STOURBRIDGE QUALITY also SILICIOUS QUALITY 81% SILICA

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Telephone: Barkston Ash 234 and 235 (Private Branch Exchange). Code: "Bentleys."

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APPOINTMENTS VACANT

THE LIVERPOOL GAS COMPANY

APPLICATIONS are invited for an ASSISTANT in the INDUSTRIAL GAS DEPARTMENT.

Applicants, who should be under 30 years of age, must have had a good education, with science and/or engineering as the main subject. They should have some drawing office experience, and be competent to carry out calculations involved in industrial problems. Some district sales experience will be an advantage.

Applicants should be the holders of the Higher Grade Certificate in Gas Supply or its equivalent.

Remuneration will not be less than £400 per annum, and the successful applicant will be eligible (subject to satisfactory medical examination) for entrance to the Officials' Superannuation Fund.

Applications (with *copy* Testimonials) should be addressed to The General Manager and Secretary, Radiant House, Bold Street, Liverpool, 1, and must be received not later than February 10, 1945.

January 11, 1945.

Advertisement issued by permission of the Ministry of Labour

THE DOVER GAS COMPANY

APPLICATIONS are invited for the position of WORKS CHEMIST. Candidates should have experience of the operation of Horizontal Retorts, Carburetted Water Gas and the Recovery of Benzole, also be capable of carrying out the routine tests required with the control of such plant. The Salary will be £300 per annum, plus War Bonus, at present £62 per annum. Applications endorsed "Works Chemist," stating Age, Experience and Qualifications, together with copies of Testimonials, to be sent to the undersigned not later than February 3, 1945.

Gas Offices, Union Road, Dover.
R. G. A. CLARK, Engineer and Manager.

COUNTY BOROUGH OF ST. HELENS

(GAS DEPARTMENT)

APPOINTMENT OF MALE TECHNICAL ASSISTANT

APPLICATIONS are invited for the position of TECHNICAL ASSISTANT at a salary of £285 per annum, rising by annual increments of £15 to £315 per annum (or commencing at an agreed figure up to £315 per annum according to experience).

A cost of living bonus is also payable in accordance with, and subject to, the Scale and Conditions of the Lancashire and Cheshire Provincial Council for the Professional, &c., Services.

The appointment is subject to the provisions of the Local Government Superannuation Act, 1937; satisfactory medical examination is essential.

Experience necessary in the operation of Gas-Works Plants, including Vertical Retorts, and in Drawing Office Work.

Give Age, Qualifications and Experience, together with *copies* of three recent Testimonials, and address same to: The Town Clerk, Town Hall, St. Helens, Lancs, endorsed "Gas Technical Assistant," so as to reach him not later than February 5, 1945.

Town Clerk's Office, Town Hall, St. Helens.
W. H. POLLITT, Town Clerk.

SLOUGH GAS AND COKE COMPANY

TECHNICAL ASSISTANT

APPLICATIONS are invited for the above position at a commencing salary of £400 per annum, plus current War Bonus of £62 per annum.

Applicants must possess the Higher Grade Engineering Certificate of The Institution of Gas Engineers, or equivalent qualification.

The successful candidate will be expected to be thoroughly conversant with laboratory practice, and previous experience in the control and maintenance of Continuous Vertical Retorts will be an advantage.

Applications, stating Age, Qualifications, Experience, and particulars of present employment, accompanied by two recent Testimonials, should be received by the undersigned not later than February 10, 1945.

Gas-Works, Uxbridge Road, Slough, Bucks.
J. H. DYDE, Engineer and General Manager.

THE WORCESTER NEW GAS LIGHT COMPANY

CHIEF TECHNICAL ASSISTANT

APPLICATIONS are invited for the above position. Candidates must have sound engineering training, also control of a modern gas-works, practical experience of continuous Vertical Retorts, Benzole Extraction, and C.W.G. Plant essential.

Brief application, stating details of Age, Education, Training, Qualifications and Experience to be addressed to:

The Worcester New Gas Light Company, Worcester.
GEO. P. MITCHELL, M.Inst.C.E., Chief Engineer and Managing Director.

APPOINTMENTS VACANT (ctd.)

WOLVERHAMPTON GAS COMPANY

SHIFT ENGINEER

APPLICATIONS are invited for the position of SHIFT ENGINEER at the Works of the above Gas Company.

Applicants must have a sound knowledge and practical experience with Woodall-Duckham Continuous Vertical Retorts, Waste Heat Boilers, Automatic Water Gas Plant, and a general knowledge of all subsidiary plant on a gas-works.

Commencing salary £325 per annum, plus 20% war bonus.

Applications, stating Age, Training, previous Experience, present occupation, together with position regarding Military Service and Essential Works Order, and with not more than three *copies* of recent Testimonials, addressed to the undersigned, must be delivered not later than February 21, 1945.

Gas Offices, Darlington Street, Wolverhampton.
A. H. CRANMER, M.Inst.Gas E., Chief Engineer.

TECHNICAL ASSISTANT (Gas-Works, N.W. Coast, 200,000,000 cu.ft.). Must be gas-works trained and hold Higher Grade Certificate of Institution of Gas Engineers in *Gas Engineering*. Practical experience with vertical retorts and carburetted water gas plant essential. Experienced in control of labour. Appointment subject to medical examination. (Local Government Superannuation Act, 1937.) Salary £360 × £15 p.a. to £405 p.a. maximum, plus £49 10s. p.a. war bonus.

Applications in writing (no interviews), stating date of birth, full details of Qualifications and Experience (including a list in chronological order of posts held), and quoting reference No. 16, should be addressed to the Ministry of Labour and National Service Appointments Office, Cotton Exchange Building, Bixteth Street, Liverpool, 3.

BOROUGH OF ILKESTON

APPOINTMENT OF GAS ENGINEER AND MANAGER

APPLICATIONS are invited from qualified Engineers for the appointment of GAS ENGINEER AND MANAGER of the Gas Undertaking, at a commencing Salary at the rate of £700 per annum (plus cost of living bonus), rising by annual increments of £50 to £850 per annum.

The appointment will be subject to the provisions of the Local Government Superannuation Act, 1937.

Applications, stating Age, Training, Qualifications and Experience and endorsed "Gas Engineer and Manager" should be delivered to the undersigned, accompanied by *copies* of three recent Testimonials, not later than Thursday, February 8, 1945.

Canvassing, either directly or indirectly, will disqualify.

Town Hall, Ilkeston, Derbyshire.
E. I. E. WILLIAMS, Town Clerk.

January 23, 1945.

SHEFFIELD AND DISTRICT GAS COMPANY

GRIMESTHORPE STATION

ASSISTANT WORKS SUPERINTENDENT

APPLICATIONS are invited for the above position at a commencing Salary of £350 per annum plus War Bonus.

Candidates must have had a sound gas works' training and should apply stating Age, whether married or single, and full details of Experience, together with *copies* of two Testimonials. The position with regard to the Essential Works Order and National Service Act should also be given.

A Co-Partnership Scheme is in operation, also an Officers' Superannuation Fund, to which latter the appointed person would contribute. It will be necessary for the successful Candidate to pass a medical examination.

Applications to be forwarded to the undersigned not later than February 10, 1945.

Sheffield and District Gas Company, Commercial Street, Sheffield, 1.
RALPH HALKETT, Director and General Manager.

PLANT &c. FOR SALE & WANTED

'PHONE 98 STAINES.

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COMPANY NOTICES

SOUTH SUBURBAN GAS COMPANY

NOTICE IS HEREBY GIVEN that the ANNUAL ORDINARY MEETING of the Proprietors of this Company will be held at the Livesey Memorial Hall, Lower Sydenham, S.E. 26 (adjoining the Chief Office), on Thursday, the 22nd day of February, 1945, at 11 o'clock in the forenoon precisely, for the following purposes:

To receive the Report of the Directors and Statement of Accounts for the year ended 31st December last.

To declare a dividend for the half-year ended the same date.

To elect two Directors and one Auditor in the place of those retiring by rotation.

And for general purposes.

NOTICE IS HEREBY ALSO GIVEN that, in accordance with the Standing Orders of Parliament, an Extraordinary Meeting of the Proprietors of this Company will be held at the same place at 11.30 o'clock in the forenoon of the same day or so soon thereafter as the business of the Ordinary Meeting of such Proprietors to be held on the same day shall have been concluded, for the purpose of considering, and, if thought fit, of approving a Bill which has been introduced into Parliament in the present Session, entitled:

"A Bill to fulfil the requirements of Section 18 of the South Suburban Gas Act, 1940."

The TRANSFER BOOKS relating to the Ordinary and Preference Stocks of this Company WILL BE CLOSED from 9th February to 22nd February, both days inclusive.

Dated this 11th day of January, 1945.

By Order of the Board,
D. L. HORLOCK, Secretary.

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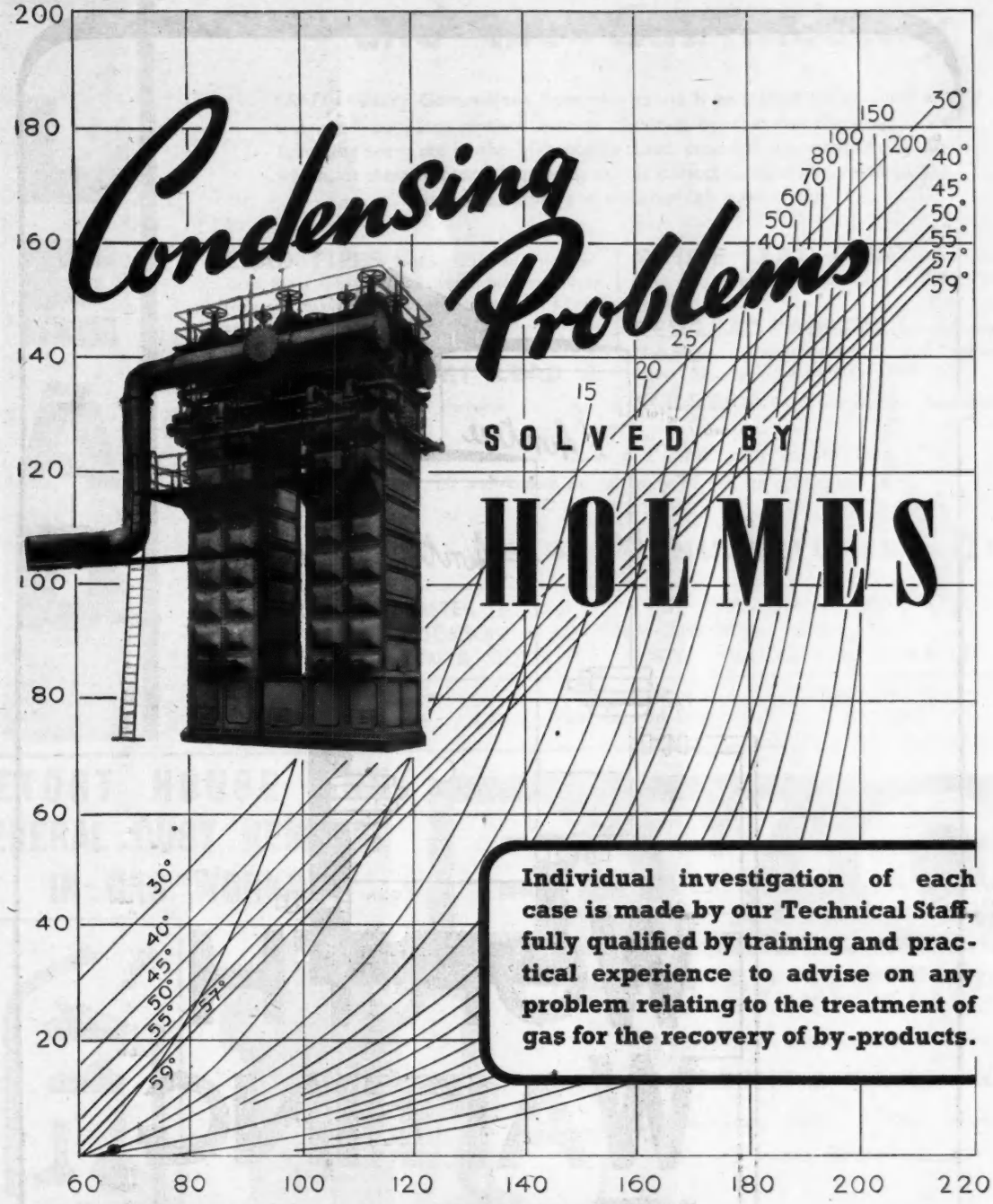
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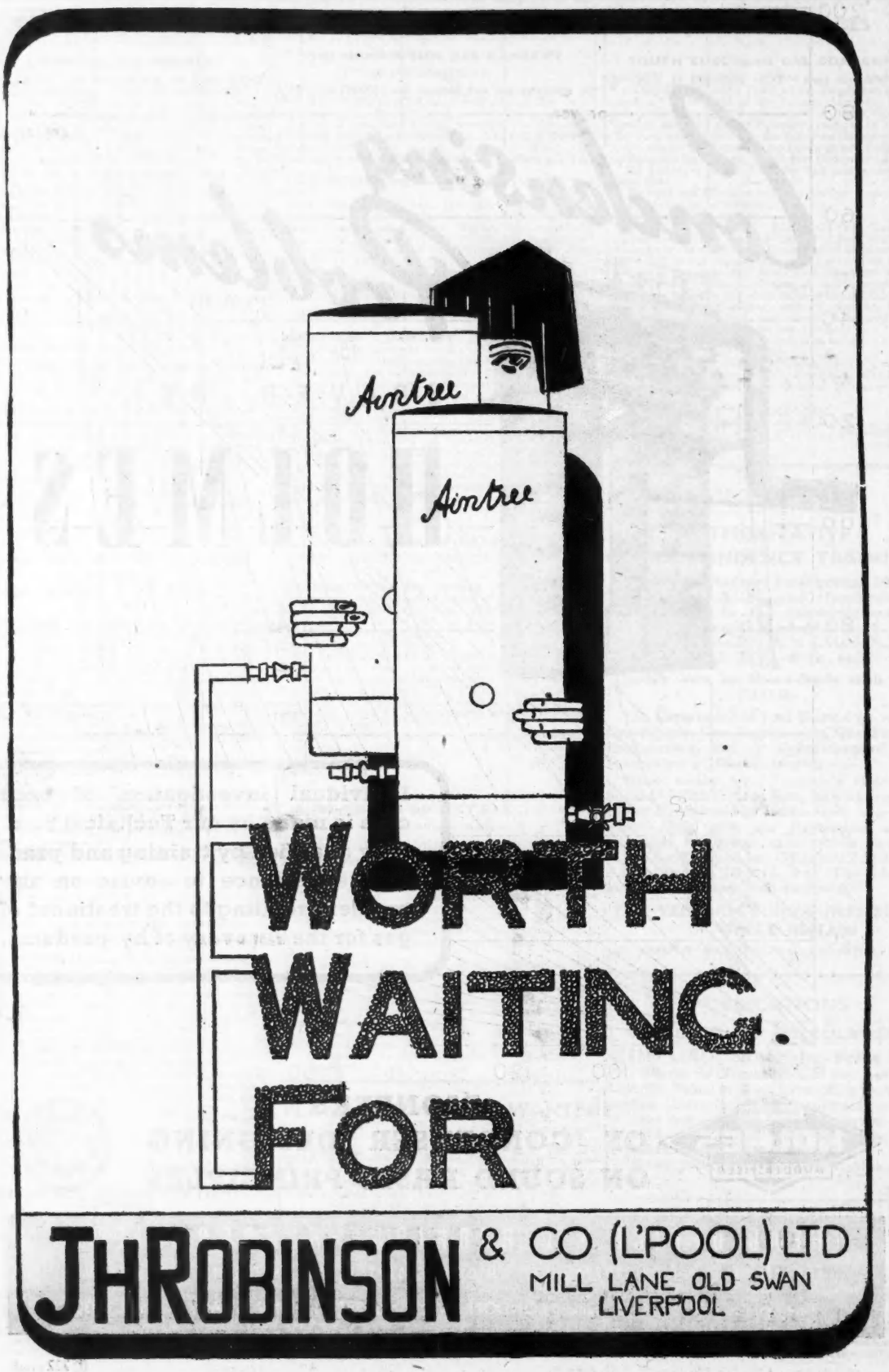
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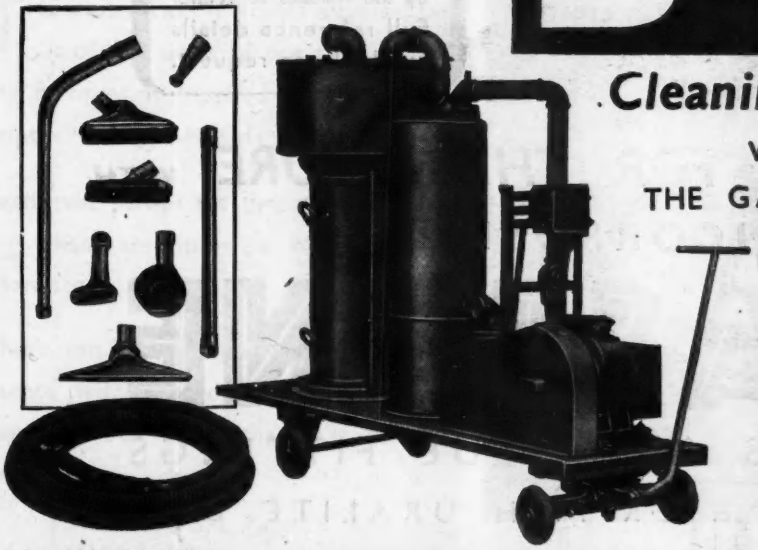

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THE GAS LIGHT & COKE CO.,
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Also

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URASTONE is at present available only under Control by the Minister of Works. Full reference details available on request.

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View of part of the APOTHECARIES' GARDEN at CHELSEA from the River

The Chelsea Physic Garden, which has been a centre of Botanical study for two and a half centuries, owes its continued existence to the generosity of Sir HANS SLOANE, who gave the freehold to the Society of Apothecaries in 1722.

John Evelyn, the diarist, records that he visited the garden in 1685. Later, in 1736, the famous Swedish botanist, Linnæus came to England especially to see it.

The two Cedars of Lebanon, planted in 1683, were the first ever brought to England. One of them survived until 1903.

From a lithograph in the possession of

GEORGE GLOVERS of CHELSEA

Gas Meter Manufacturers

WIRE ANNEALING

THE illustration indicates a typical layout of two units of pot type annealing furnaces as supplied to a number of important Wire Manufacturers.

Each unit comprises preheat and heating chambers followed by a cooling chamber.

Units can be supplied to suit requirements with regard to pot size and capacity, but usual charge is 10 cwt. per pot.

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Give GASHOLDERS and other steel structural work the best possible

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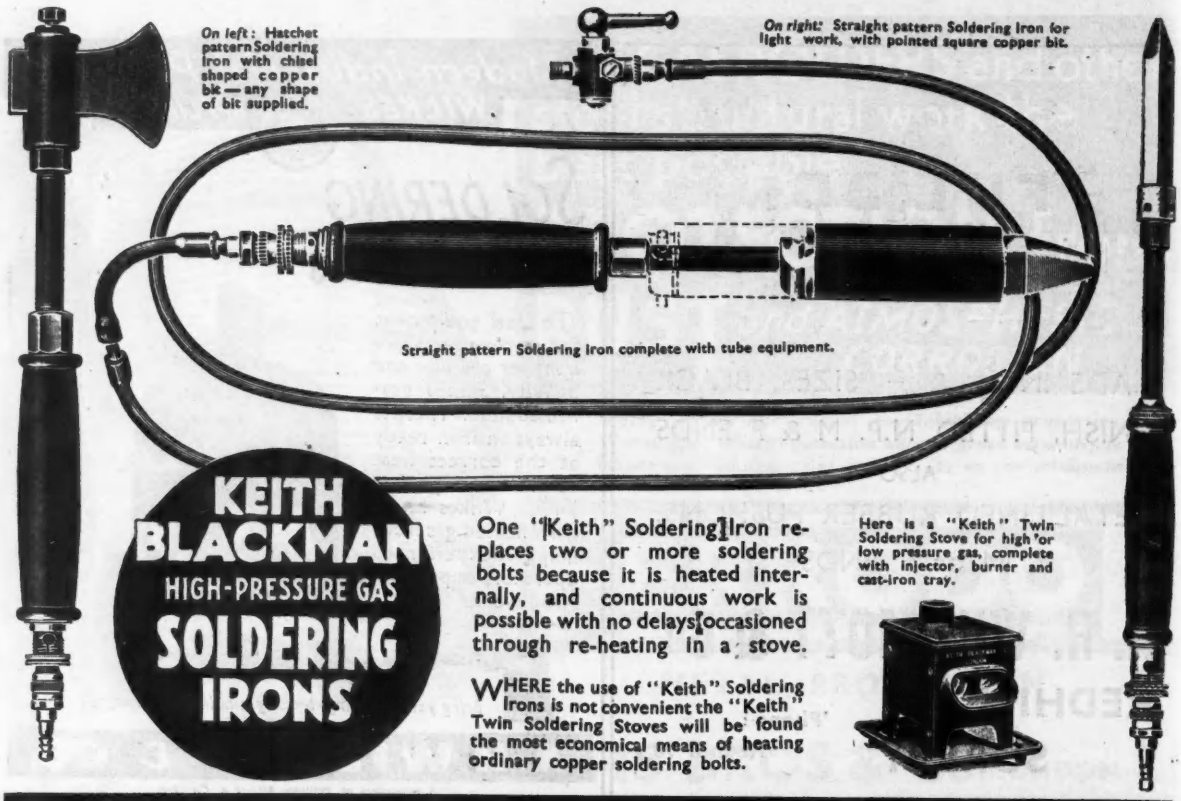

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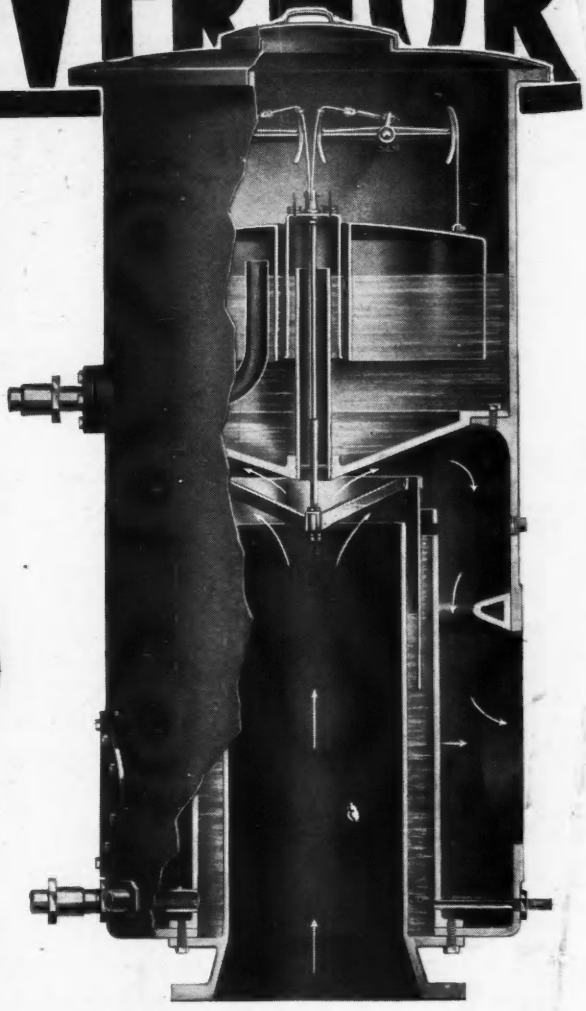

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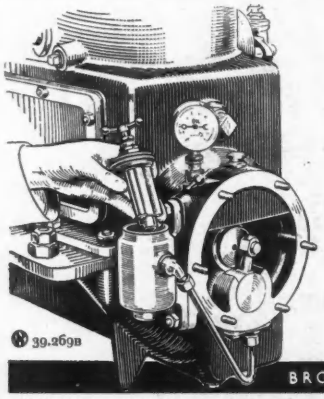

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